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Section of Laryngology with Section of Otology

JOINT SUMMER MEETING HELD AT THE SCARBOROUGH HOSPITAL, SCALBY ROAD, SCARBOROUGH

LARYNGOLOGICAL SESSION

[*June* 11, 1954]

Chairman—C. P. WILSON, C.V.O., F.R.C.S.
(President of the Section of Laryngology)

DISCUSSION ON THE TREATMENT OF NASAL POLYPI

Mr. S. W. G. Hargrove:

The name polypus was used by Galen, who likened the growth to a sea polyp. Lambert Lack (1906) has defined a nasal polyp as a new formation springing from the ethmoidal region of the nose, consisting mainly of a loose net-work of fibrous tissue, together with more or less of the other tissues normal to the region. They may be round, oval or pyriform, are often pedunculated, and have a pinkish or bluish semi-translucent appearance, varying in size from a currant to an acorn or larger, and give rise to nasal obstruction, with its associated symptoms. Polypi arise most commonly from the nasal mucosa of the ethmoidal labyrinth—the more common sites being the undersurface of the middle turbinate, the uncinate process and the bulla ethmoidalis. It is rare for polypi to grow from the septum and the upper part of the nose. They are said never to grow from the inferior turbinate or the roof of the nose. Hippocrates describes the main clinical features of nasal polypi and recommended that a string should be passed through the nose and drawn out through the post-nasal space into the mouth, and that a sponge having the same diameter as the nostril should be attached to the string and forcibly pulled through the nose from behind, forwards. Celsus in the first century recommended the use of astringents and was opposed to forcible removal. William of Salicet introduced the method of strangulation by tying ligatures round the pedicle of the growth and when not possible, used forceps to remove the polyp. Morgagni and Valsalva recommended the removal of the lamina of the bone to which the polypus was attached in order to prevent its recurrence. Surgery in the form of avulsion with forceps was in use towards the end of the eighteenth and beginning of the nineteenth century. These forceps had special curves for introducing into the nose and pharynx—the tumour was torn away in many cases with disastrous results—the hæmorrhage following this procedure was frequently fatal—the ethmoid being ripped out and even tearing away the septum. The snare was first introduced by Robertson of Edinburgh in 1805 and is the original snare which is in present use. In 1884 Morrell Mackenzie recommended the use of the electric cautery and punch forceps, the latter he used only to take away the dead tissue. As early as the seventeenth century it was realized that in order to effect a cure the bone from which the polypus was growing had to be removed. Woakes in 1885 was the first to show that nasal polypi were associated with a disease of the ethmoid, which he called a "necrosing ethmoiditis". From 1885 the removal of nasal polypi by the intranasal route was gradually modified and such names as Sluder, Hajek, Mosher and Ballenger are associated with the modifications of the intranasal ethmoidectomy. Ogston in 1884 appears to be the first surgeon to operate on the ethmoid by an external approach, he made a vertical incision over the roof of the nose upwards on to the forehead for 1 in. and opened the frontal sinus by trephining. He enlarged the ostium and infundibulum canal with a gouge and passed a tube into the nose. Luc in 1894 adopted this method and his incision was made in the supra-orbital region (Luc, 1900). This operation then became known as the Ogston-Luc method. Janson followed with an incision parallel to the supra-orbital ridge—turned back the roof of the orbit and removed the entire inferior wall of the frontal sinus with its mucous membrane and curetted the ethmoidal region. Guisez in 1902 was the first surgeon to operate on the ethmoid without disturbing the frontal sinus. He made an incision starting at the inner edge of the eyebrow and, descending to the inner angle of the eye, passing below the lacrimal fossa. Dissection was then made until the lacrimal sac was exposed and pushed laterally. The lacrimal bone and portion of the frontal process of the superior maxilla were resected and the ethmoidal labyrinth entered through the lacrimal fossa, the cells were then removed, together with the middle turbinate. The lamina papyracea was also removed as far back as the fronto-ethmoidal suture.

Ætiology.—Polyposis is a symptom of a generalized disease. The cause of this generalized disease is a sensitization to a particular antigen—the patient may be strongly sensitive and lack resistance, but this sensitivity may gradually decrease, or remain stationary. It is generally accepted that polypi are allergic in origin but may become secondarily infected. It is said that polypi may arise from a chronic state of infection with no allergy present, but this is doubtful.

DEC.

THE PATHOLOGY OF CHRONIC INFLAMMATION OF THE ETHMOIDAL LABYRINTH

Two examples of the classification of chronic ethmoiditis have been taken. Skillern in 1923 classified chronic ethmoiditis thus:

(1) Chronic catarrhal inflammation (hyperplastic ethmoiditis).
(2) Chronic suppurative inflammation (empyema).
(3) Chronic catarrhal inflammation with suppuration.

(1) and (2) are entirely separate and distinct. (3) is a combination of (1) and (2).

whilst Eggston and Wolff (1947) classify ethmoiditis as a chronic inflammation involving the sinuses as a whole:

(1) Hypertrophic or polypoidal sinusitis.
(2) Sclerosing, fibrotic or arteriofibrotic (atrophic) sinusitis.
(3) Papillary sinusitis.
(4) Follicular sinusitis.
(5) Glandular or adenomatous sinusitis.

Skillern believed that in hyperplastic ethmoiditis the causative factor depended on a protracted and continual disturbance in the nutrition of the ethmoidal capsule rather than on an inflammation with bacterial invasion, and that a mechanical cause seemed to be pre-eminent; whilst Eggston and Wolff believed that polypi arise because of basic vascular changes in the nasal mucosa. These changes are due to repeated attacks of sinusitis with infection which eventually lead to a periphlebitis and perilymphangitis resulting in an obstruction to the return flow of interstitial fluids—this obstruction causes a passive congestion and results in an œdema of tunica propria with hypertrophy and polypoidal formation. The œdema of the stroma causes a disturbance of the nourishment of the underlying bone with decalcification and absorption of the bone. In the sclerosing or atrophic type there is a submucous fibrosis and no œdema of the stroma. The afferent vessels are affected and a cellular reaction can be seen involving the arterioles and arteries and this leads to an endarteritis and thrombosis. In papillary sinusitis the epithelium shows a metaplasia from a pseudo-stratified ciliated columnar to a stratified squamous epithelium. It is said that this type of sinusitis may become malignant but Eggston and Wolff have proved that this lesion is an inflammatory hyperplasia. The follicular and glandular type of sinusitis need not be regarded as a separate type of sinusitis. Lymphatic follicles and hyperplastic changes in the glands may be seen in any type of sinusitis. The bony changes in chronic sinusitis may be of two types. The osteoporotic, in which the bone may become thinner, the trabeculæ atrophic and friable and eventually absorbed. This type is seen in the polypoidal sinusitis and this appears to be due to pressure. In the osteoblastic type the density of the bone increases. It is said that the bones of the sinuses have no periosteum, but this regeneration of bone and the fact that osteoblast can be seen in the lining membrane of the bones prove that there is a periosteum present.

The following is the case history of a patient who had had numerous intranasal operations prior to a bilateral external ethmoidectomy. From Figs. 1–3 it can be seen that a case of simple polypoidal ethmoiditis has been converted into a mixed type of ethmoiditis. Figs. 1–3 show areas typical of a fibrotic ethmoiditis, with endarteritis and thrombosis affecting the afferent vessels, and also areas with a periphlebitis affecting the efferent vessels.

A woman, aged 39, married, had suffered with nasal polypi since the age of 21. Between 1935 and 1952 she had had polypi removed on at least twelve occasions. She complained of difficulty in breathing through the nose, together with severe headaches and a profuse nasal discharge with loss of taste and smell. Ethmoids, antra and frontals on both sides were opaque to X-rays. In July 1952 she had a left external ethmoidectomy under a general anæsthesia. Ethmoids were very sclerotic and the bone thickened, especially the lamina papyracea. Many polypi were found in the ethmoidal region and the antral mucosa was markedly thickened and polypoidal. Six months later a right external ethmoidectomy was performed, and when reviewed on April 8, 1954, no polypi were seen on anterior rhinoscopy right or left. Her general health was much improved, taste and smell had returned to normal, and there was no crusting. Headaches were now much improved. Before operation she suffered from loss of appetite and lack of concentration—now returned to normal. Mr. C. Taylor reported the vision of the right eye 6/6, left eye 6/6. The fundi were normal, no epiphora and no history of diplopia. Orthoptist reported no symptoms, and muscle balance within normal limits.

Treatment.—When a patient is first seen in Outpatients suffering from polyposis and the polypi have not been previously removed, an X-ray is taken of the sinuses and ethmoidal region in order to ascertain what degree of infection is present. In most cases it is difficult to demonstrate ethmoidal polypi on X-ray but films are useful to demonstrate the distribution of the ethmoidal cells. It is only when infection is of long standing that the bony walls of the ethmoidal cells and other sinuses show a sclerosing osteitis. In polypoidal sinusitis the bone tends to become osteoporotic and thin but these changes are not clearly shown on X-ray. X-rays of the chest are also taken to exclude any infection such as bronchiectasis. This is most important in young people suffering from polyposis with suppuration. If there is a strong allergic incidence in a particular case the patient is referred to the Allergic Clinic for advice and treatment. The nose and throat are sprayed with Xylocaine and adrenaline 1 : 1,000 and the postnasal space is examined to exclude an antrochoanal polyp. The polypi are then removed under local anæsthesia using a snare to ascertain exactly from what region

the polypi are growing. At the first sitting as many polypi as possible are removed and an examination is made one week later. If any polypoidal remnants are present a further removal is made without disturbing the ethmoidal cells. The patient is then asked to return in six months' time. If there is a further growth of polypi the patient is admitted to hospital and under a general anæsthetic the middle turbinate is elevated and if necessary the anterior end resected in order to obtain a better view of the ethmoidal region. A limited removal of ethmoidal cells is then performed. By carrying out this type of treatment the spread of infection into the ethmoidal labyrinth is limited and in many instances this is all that is needed. If the polypi recur, and are found to be widely distributed in the ethmoidal labyrinth, further removal may be tried, but repeated intranasal operations will cause infection to spread. It is disconcerting to the patient to have repeated operations and will in time cause general ill-health. Hajek states that a number of cases are incurable by the intranasal method and a half-cure is all that can be expected and should be aimed at when the disease is extensive. One should try to avoid converting a relatively non-suppurative ethmoiditis into a mixed type with areas of polyposis and fibrosis. Repeated traumatization of the cells leads to a progressive infective condition and this will cause a proliferative osteitis, the periosteum lining the cells becomes congested and granulomatous tissue appears, osteoblasts will migrate into this tissue and calcium salts are deposited and thus the bone becomes thickened. The tissue changes are irreversible and one should then perform a radical operation using an external approach. The operation of my choice is the Norman Patterson operation, which will be described in detail.

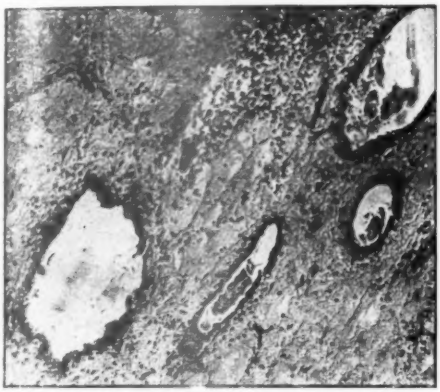

FIG. 1.

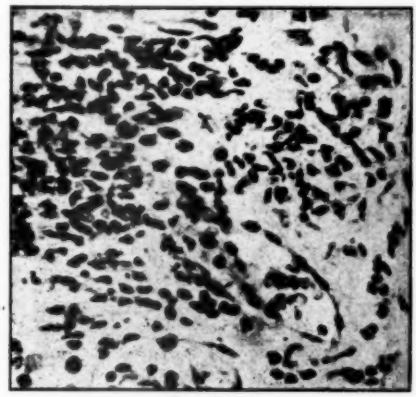

FIG. 2.

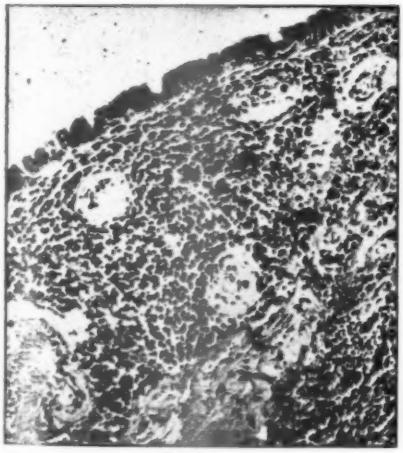

FIG. 3.

FIG. 1.—The centre of a polyp showing a group of dilated mucous glands lying in a loose and œdematous stroma infiltrated by inflammatory cells mainly eosinophils and plasma cells. Areas of recent hæmorrhage can be seen at the lower part of the picture. × 50.

FIG. 2.—A small vein lying in the loose stroma of a polyp; it is surrounded by a collection of inflammatory cells which are mainly lymphocytes—periphlebitis. (The venule has been cut obliquely and is passing up and to the left through the centre of the node of inflammatory cells.) × 200.

FIG. 3.—The surface of this polyp is covered with ciliated columnar epithelium beneath which is a stroma packed with inflammatory cells, nearly all plasma cells. Four or five arterioles can be seen with considerably thickened walls with reduction in size of the lumen—this is not an acute arteritis, but represents a reaction to chronic inflammation. × 125.

External ethmoidectomy operation (Figs. 4–10).—The patient is prepared in the usual way as for any surgical operation, the skin is prepared with acriflavine in spirit. General anæsthetic is used in all cases, using a cuffed endotracheal tube and a pack soaked in saline. Nitrous oxide, oxygen and intravenous pethidine are used, and a trace of trilene as required.

The eyelids are sutured to prevent damage to the cornea, and an incision is made ½ in. below and external to the inner canthus and corresponds to a sulcus which can be seen passing outwards and downwards into the cheek.

The orbicularis oculi muscle is incised, and using blunt dissection the superficial fibres are divided in the line of the incision. Mosquito forceps are then applied to the superficial fibres of the divided muscle, and the deep fibres of the orbicularis oculi are further separated by blunt dissection. At each stage of the division of the orbicularis oculi a small self-retaining retractor is inserted between the divided fibres and helps to control hæmorrhage. At this stage of the operation a small vessel lying in the medial end of the incision may be traumatized.

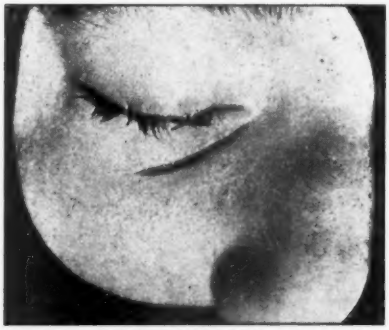

FIG. 4.—Incision begins half an inch below and external to the inner canthus and corresponds to a sulcus, which can be seen passing outwards and downwards into the cheek. (The eyelids have been sutured.)

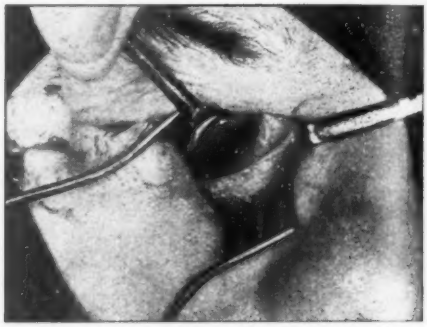

FIG. 5.—The nasolacrimal duct is exposed.

FIG. 6.—A small portion of the roof of the antrum is removed using a gouge and the opening enlarged.

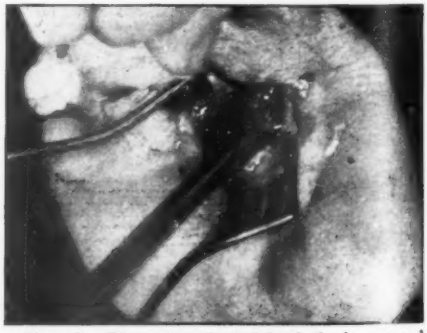

FIG. 7.—The ethmoidal labyrinth is entered posterior to the nasolacrimal duct. Periosteum lining the inner wall of the orbit is elevated and the lamina papyracea is nibbled away and a large number of polypi come away with the bone.

The bone forming the margin of the orbit, which lies in relation to the skin incision is incised. The periosteum is elevated from the orbital floor as far medially as the internal tarsal ligament and nearly as far laterally as the inferior orbital foramen.

The nasolacrimal duct is exposed, and a small portion of the roof of the antrum is removed, using a gouge, and the opening enlarged. Polypoidal lining of the antrum is removed with Luc's forceps. (At this stage of the operation the antronasal wall above the inferior turbinate is nibbled away with Luc's forceps.)

The mucous membrane lining is removed where diseased and a pack placed in the antrum to control hæmorrhage.

The ethmoidal labyrinth is then entered posterior to the nasolacrimal duct, and the periosteum lining the inner wall of the orbit is further elevated.

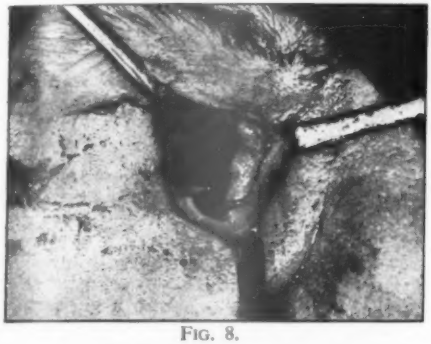

FIG. 8.

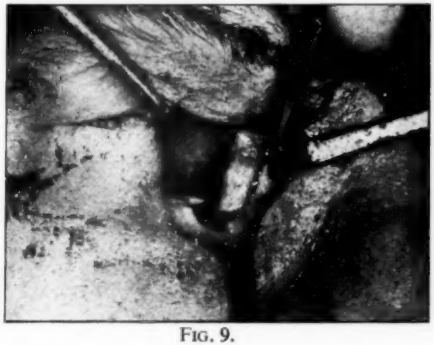

FIG. 9.

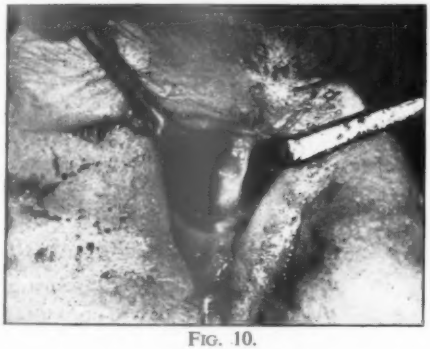

FIG. 10.

FIG. 8.—The orbital contents are retracted showing the edge of the lamina papyracea.

FIG. 9.—The soft tissues lying over the frontal process of the maxilla are elevated. The bone lying in front of the nasolacrimal duct is removed with a sharp gouge.

FIG. 10.—The lacrimal sac is then dislodged from its bed and the lacrimal bone removed, together with polypi (bimanual approach through the nose and through the incision helps in their removal).

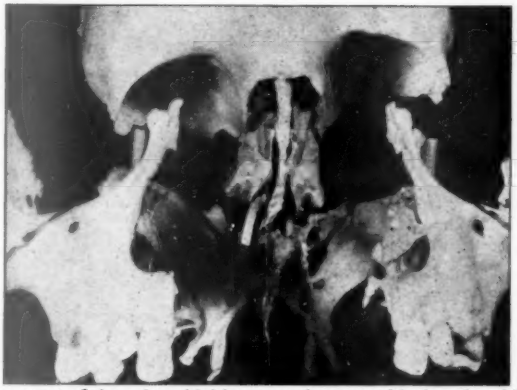

FIG. 11.—The anterior aspect of the sphenoidal bone can be seen with the ethmoid tilted slightly upwards. The maxillæ are retracted laterally and the frontal bone elevated showing the notch into which the crista galli passes, and the region of the frontal bone, which articulates with the roof of the ethmoid. Rubber tubes can be seen extending from the frontal sinus into the infundibula and entering the middle meati. Also shown are the openings of the sphenoidal sinus, optic foramen, foramen rotundum, pterygoid canal, right sphenoid concha and superior orbital fissure. In this skull ethmoidal cells can be seen lying anterior to the frontonasal duct, and the relationship of the lacrimal bone and frontal process of the maxilla to these cells and the ring of bone which forms the anterior part of the floor of the frontal sinus can also be seen.

The lamina papyracea is nibbled away using Luc's forceps and a large number of polypi come away with the bone. The soft tissues overlying the frontal process of the maxilla are elevated and the bone lying in front of the nasolacrimal duct is removed with a sharp gouge.

The lacrimal sac is then dislodged from its bed laterally, and the lacrimal bone removed, together with many polypi which are found in this area growing from the anterior ethmoidal walls. Bimanual approach through the nose and through the incision helps in their removal.

The whole of the ethmoidal labyrinth is removed, together with the medial third of the floor of the orbit, the lacrimal bone and a portion of the frontal process of the maxilla lying anterior to the nasolacrimal duct. Care must be taken in removing the posterior third of the lamina papyracea owing to the close proximity of the optic foramen which is lying in the lesser wing of the sphenoid.

Air cells may be found lying in front of the infundibulum and their walls are completed by the lacrimal bone and the frontal process of the maxilla. In 50% of cases the infundibulum passes through the ethmoidal cells, thus the ethmoidal cells will be found lying in front of the infundibulum. In the other 50% of cases no cells are found anteriorly, and the lacrimal bone and the frontal process of the maxilla are a direct anterior relationship. This area is removed at operation, and it will be seen that all that remains of the frontonasal duct is a ring of bone in the anterior part of the floor of the frontal sinus.

The fibres of the orbicularis oculi are drawn together with interrupted catgut sutures and this ensures perfect closure of the incision which relieves tension on the skin sutures and also prevents the skin becoming attached to the periosteum overlying the maxilla. The skin is closed with interrupted ophthalmic silk sutures.

Post-operative treatment.—Paroleine drops are placed in both eyes in the operating theatre before the bandages are applied. The nose is not packed. 100 mg. pethidine are given six-hourly as required, and Omnopon $\frac{1}{3}$ grain—if necessary on the first night. Bandages are removed after twenty-four hours following operation and the wound painted with sterile gentian violet jelly. The patient is put on a course of penicillin 300,000 units b.d for five days. Sterile Paroleine drops are placed in the eye for the first forty-eight hours, and the patient instructed not to blow the nose for at least four to five days. Forty-eight hours after operation ephedrine drops in Paroleine are used to soften the crusts, followed by inhalations b.d. On the fifth day the stitches are removed and the naso-lacrimal duct washed through with penicillin. The nose is inspected on the fifth day and crusts removed. This is most important and may have to be repeated up to the fourth to sixth week after operation. Patient is discharged from hospital on ten to twelve days with inhalations and ephedrine drops in Paroleine.

Results.—71 cases of polypoidal sinusitis were operated on by the Norman Patterson external approach between 1945 and 1954. In 30 cases the operation was bilateral, with an interval of at least six months between each operation. In all cases previous removal of nasal polypi by the intranasal route had been performed on numerous occasions. Age is not of great importance; the youngest patient operated on in this series was 15, and the oldest 71. In only one case has there been permanent crusting following operation. These cases have been seen at six-monthly intervals in outpatients for the first two years and then at yearly intervals, to make sure that there is no recurrence of the polypi. Only in one instance has there been any gross recurrence and this patient had a markedly allergic type of mucous membrane and at operation polypi were found widely distributed and even growing from the septum. The mucous membrane was so wet and soggy that several treatments with zinc ionization had to be given to keep an airway. In 7 cases small polypoidal tags were removed under local anæsthesia but no gross recurrence had taken place. The technique of the operation can be slightly modified if necessary—the incision may be prolonged laterally to give better access to the antrum and medially towards the inner canthus—the latter gives a freer access to the fronto-ethmoidal region, and does not alter the scar. If the medial floor of the orbit is removed for at least one-third of its extent this gives a better view of the antrum. The frontal sinus and the sphenoidal sinus are washed out with saline if it is necessary, but otherwise the boundaries of the frontal and sphenoidal sinuses are not disturbed.

Summary.—The object of the operation is to remove all polypus-bearing areas, including lamina papyracea, middle and superior turbinates, and the whole of the ethmoidal labyrinth. Recurrence should not take place if these areas are eradicated. After the operation the scar is scarcely visible, and in some cases the patient had to be asked which side had been treated. The operation affords free access to all sinuses except the frontal. As the infection in pan-sinusitis associated with polypi is centred in the ethmoid, the headaches present in many of these cases are often cured or relieved as the result of improved drainage. In several such cases polypi were removed from ethmoidal cells in the region of the frontonasal duct, and infection in the frontal sinus may clear up after this procedure. The general health was very much improved; smell and taste returned on an average six to eight months after the operation in nearly all cases where they were previously lost or defective. Often the general health and the local condition of the nose improved so much after a unilateral operation that the patient asked for a further operation on the other side.

A film in colour of the external ethmoidal operation was shown.

In conclusion I would like to pay tribute to my old Chief—Mr. Norman Patterson—to whom I owe so much. In my opinion he was a very great man and without his knowledge and help I would not have been able to read this paper to-day. I would also like to thank Mr. R. T. Ross of the pathology department 15 Hospital Group, Shrewsbury, for his help in preparing the slides and in making the film.

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Mr. C. Taylor: *The Relation of the Ocular Muscles to the Norman Patterson Operation*

Mr. Taylor gave an interesting demonstration on the anatomy of the orbit and especially of the muscles and fasciæ and ligaments. He then went on to describe the operation:

The incision is made through the skin and the orbital portion of the orbicularis muscle in the region of the orbital margin. Fibres of the orbicularis oculi muscle are here attached to bone. The line of separation of the periosteum is below the attachment of the orbital septum. If the line of separation is too high the orbital septum will be penetrated and orbital fat encountered (Fig. 1).

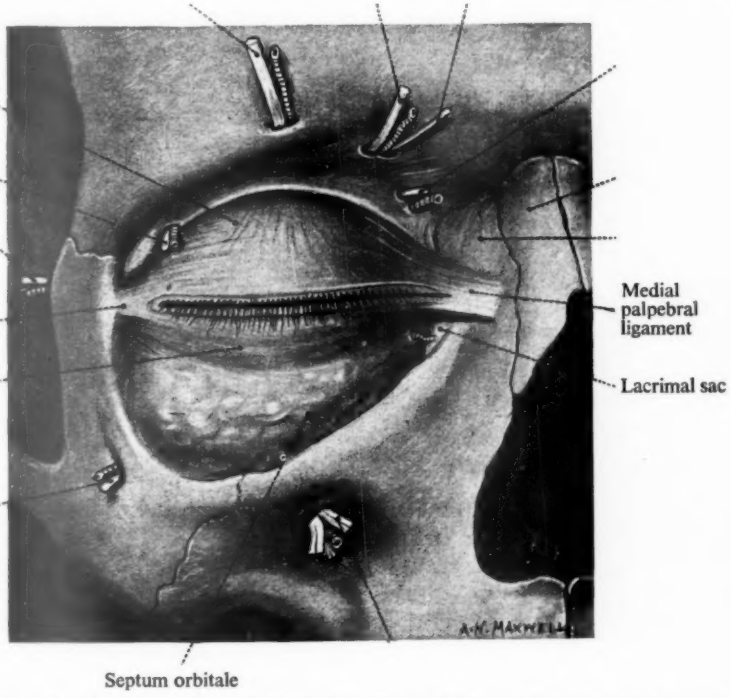

FIG. 1.—Dissection of orbit from in front. Orbicularis oculi muscle reflected to show orbital septum.

If the periorbita is buttonholed when separating it from the orbital floor the inferior oblique muscle may be divided within the periorbita and not separated from the bone with the periorbita as

intended (Fig. 2). The periorbita related to the medial wall is divided along the line of the posterior lacrimal crest. From before backwards along this crest are attached Horner's muscle, the orbital septum and the check ligament of the medial rectus muscle, all of which are separated from their

FIG. 2.—Dissection of orbit from in front. Orbital septum and some of orbital fat removed.

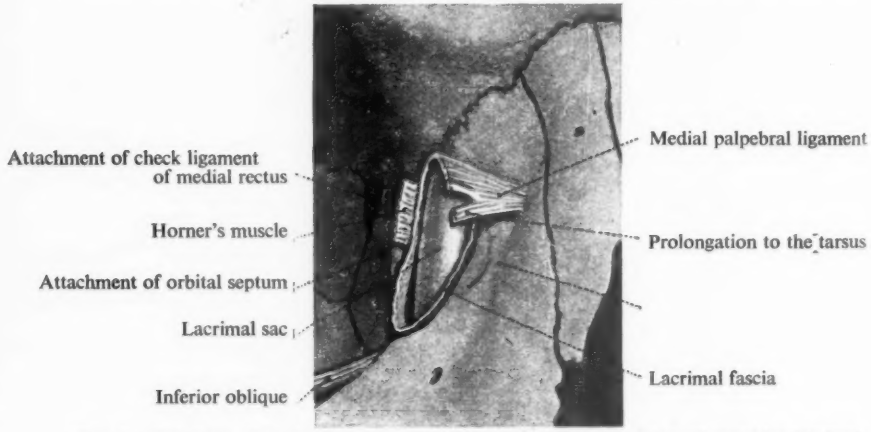

FIG. 3.—Relations of lacrimal sac. Shows various structures in region of posterior lacrimal crest which are separated from the bone in this operation.

bony attachment. Horner's muscle may or may not be recognized at the upper end of the crest but care is necessary to avoid damage to the canaliculi which lie just in front of it at this point (Figs. 3 and 4).

When stitching up after operation the orbicularis oculi muscle is sutured separately. In so doing the periosteum is in some measure reattached to bone and so the inferior oblique muscle also regains as it were a *pied-à-terre*.

Ocular complications of this operation.—An enquiry was conducted on 32 cases referred for examination to consider whether there was (*a*) *Disturbance of tear drainage* which might be associated with disturbance of Horner's muscle or injury to the canaliculi or the lacrimal sac. (*b*) *Loss of visual acuity* due either to direct pressure on the eye or direct or indirect injury to the optic nerve, or (*c*) *Disturbance of muscle balance* due to interference with the origin of the inferior oblique muscle or the check ligament of the medial rectus muscle. Results of the enquiry were as follows:

(*a*) In no cases was there any epiphora attributable to the operation. Epiphora may occur, however, in the first few days immediately following operation.

(*b*) In no case was there any complaint of loss of visual acuity as a result of operation. The visual acuity was recorded with and without glasses. The media and fundi were examined and revealed no pathology attributable to the operation.

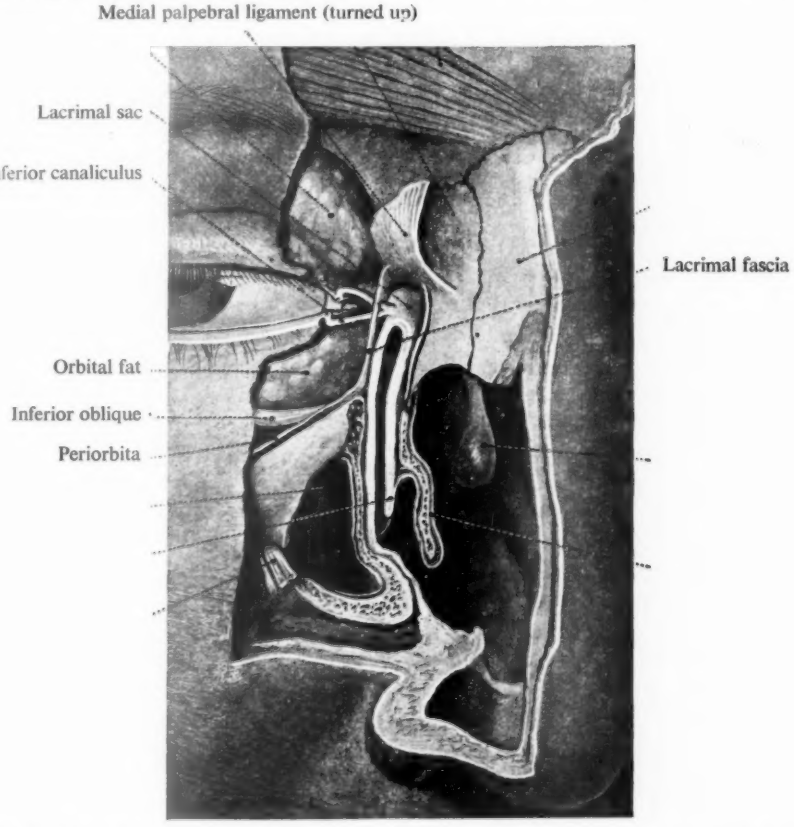

FIG. 4.—Dissection to show the relations of the lacrimal sac and nasolacrimal duct from in front.

Figs. 1–4 are reproduced from Wolff, E. (1948) "Anatomy of the Eye and Orbit," 3rd edition. By kind permission of H. K. Lewis and Co. Ltd., London.

(*c*) Two cases had a frank paresis of the inferior oblique muscle directly due to operation. The muscle balance was investigated in all the other cases by the Maddox Rod and Wing tests and was found to be within normal limits. 7 patients complained of double vision following operation. In 5 the double vision was present only for ten to fourteen days. The remaining 2 cases are those already quoted as having paresis of the inferior oblique muscle. 9 patients not included in this series were examined within a few days of operation. In 6 cases the patient did not complain of double vision but in all cases this could be elicited by asking the patient to look up. Within ten to fourteen days diplopia could no longer be elicited.

Of the 2 cases with paresis of the inferior oblique one is a housewife aged 54 years who is rather small. She had a right external ethmoidectomy done in March 1952. Since then she has had diplopia

but states that it does not trouble her much. She notices it chiefly when talking to people close up to her. She has only a mild paresis of the right inferior oblique muscle but the vision of the right eye (6/6) is much better than that of her myopic left eye (6/36) so she prefers fixing with the paresed right eye and this increases the separation of the images. She does not wear correcting lenses for distant vision. She keeps her chin slightly raised to avoid diplopia.

The other case is a man aged 47 who had a left external ethmoidectomy in November 1952. He is a charge-hand fitter. He has a paresis of the left inferior oblique muscle. He has no trouble in doing his work. He has no diplopia on looking down and avoids diplopia otherwise by tilting his head.

The inferior oblique muscles act with the superior recti in elevating the eyes. On looking up and to the left, the left superior rectus and the right inferior oblique act together. On looking up and to the right the right superior rectus and the left inferior oblique act together.

This man has a left inferior oblique palsy so diplopia will be greatest when he looks up and to the right. He subconsciously adopts a head posture so that he avoids looking in this direction. He tilts his head backward and turns it slightly and thus avoids diplopia. As these two people seem to have overcome their difficulty no further therapeutic measure has been adopted. The man has recently had a right external ethmoidectomy done so the case will be reviewed again.

Summary.—The only ocular complication met with in the cases examined was paresis of the inferior oblique muscle which was found in 2 of these cases. A transient diplopia due to weakness of this muscle may be present for about ten to fourteen days immediately following operation and a transient epiphora may also occur during this period.

For anatomical descriptions of the anatomy of the orbit and its contents the reader may refer to the following textbooks:

(1) "Anatomy of the Eye and Orbit," by Eugene Wolff, 3rd edition, London, 1948 (from which the illustrations are taken).

(2) "The Anatomy of the Human Orbit," by S. E. Whitnall, 2nd edition, London, 1932.

(3) "Textbook of Ophthalmology" (Vol. 1), by Sir Stewart Duke-Elder, London, 1938.

I wish to thank Mr. Ross of the Pathology Department for so kindly making reproductions of the illustrations, Miss Graves and Miss Rathbone for their co-operation in investigation of the muscle balance in the Orthoptic Department, and the Outpatients staff for the extra work entailed.

Mr. M. Spencer Harrison: *The Norman Patterson Operation*

Patterson's operation is really only a modification of the accepted external ethmoidectomy and its great value is that it allows a wider exposure and hence a better clearance of the ethmoid cells than any other method. The fact that the antrum can be exposed through the same opening is of quite secondary importance; it would be difficult to carry out a wide ethmoidal clearance by any route without opening the antrum. The Caldwell-Luc and the Patterson approaches have, of course, the added advantage of a good view of the antral cavity. The transantral approach to the ethmoids gives a less adequate exposure of the sphenoidal sinuses than Patterson's which also gives, after a small extension of the incision, a good exposure of the floor of the frontal sinus. This operation has been used during the past eight years on 81 occasions in 68 patients and has been found most satisfactory. It is too early, as yet, to know how successful it has been in preventing the recurrence of nasal polypi; none of these cases has required further operation to date, though a small number may require further polypectomy.

The indications for external ethmoidectomy are:

(1) Frequent and rapid recurrence of nasal polypi, particularly if there is X-ray evidence of sinus pathology.

(2) Recurrent polyposis with expansion of the nasal bridge. This condition occurs occasionally even in children and may be most disturbing. Two girls 13 years of age who had had polypi removed over several years and who had a marked broadening of the nasal bridge were operated on six and seven years ago, and have remained free of polypi.

(3) A history of previous ethmoidal surgery of uncertain extent. Further intranasal ethmoidal surgery in most of these cases is difficult, unsatisfactory and may be dangerous.

(4) Caries of the orbital plate. Absorption of the protecting barriers of the surrounding vital structures slowly occurs in widespread polyposis and yearly fatalities and serious complications are associated with intranasal ethmoidal surgery with inadequate visualization of the upper part of the nose.

(5) The frontal sinus requires opening also. It has been found that if the upper part of the nose and anterior ethmoidal labyrinth is reasonably wide an opening of such dimensions can be made in the floor of the frontal sinus after removal of the ethmoidal cells that the opening will remain patent without skin grafting and a tube need remain in position for a few days only.

In many cases recurrence of nasal polypi will not be prevented nor extensive ethmoidal infection treated effectively without the removal or opening of all the ethmoidal cells. Continued suppuration in this area after operation, particularly if it is walled off by fibrous tissue, is difficult to diagnose and may result in troublesome neuralgia or recurrent frontal sinus infection.

The *investigation* of a case of nasal polyposis should include an X-ray of the nasal accessory sinuses and treatment should aim at the elimination of any infection. Failure to deal adequately with the sinus infection is likely to result in the rapid recurrence of nasal obstruction.

Half of the cases of nasal polyposis presenting at outpatient clinics have an infection in their sinuses. Out of 551 of these cases consecutively operated on, 272 have been shown on antral wash-out to have an infection in one or both antra. A very high proportion of these cases had an infection in the ethmoidal cells also. 248 cases showed abnormalities in the antra on X-ray but no infection was found. In only 31 cases were the sinuses clear on X-ray. The simple removal of polypi in these cases with infected sinuses often does little to deal with the infection and though the focus of sepsis may not be of great importance, by lowering the patient's health and resistance it lessens the time interval between subsequent visits for polypectomy. The patient's general health is important.

Any allergic condition should also be considered and obvious causes eliminated. Skin tests are useful in pollinosis but not so valuable in food allergies though Shambaugh (1945) states that in his hands 30% of these give positive skin test results. In my own practice careful routine skin tests in approximately a hundred cases with nasal polypi with no history of pollinosis gave no significant positive results. These tests have thus been discontinued and the time is spent in trying to obtain a lead as to the basis of the allergic manifestation from the patient's history though even with this method successes are by no means frequent. Dietetic trials are cumbersome and demand considerable co-operation and intelligence on the patient's part.

Though there appears to be very little doubt concerning the importance of allergy in the ætiology of nasal polyposis, treatment of the allergy has little influence on the recurrence of the polyp. Hollender (1947) specifically immunized 22 patients before and after the operation of nasal polypectomy and yet 18 of these had a recurrence of the polyps in two to six months. So it seems that once the tendency to polyposis has become established the patient's allergic state has little, if any, relation to it.

For whatever condition the operation for nasal polypi is primarily undertaken there is little doubt that pulmonary complications unassociated with immediate post-operative inhalation of septic nasal secretions do occur. The physician, in fact, sees more of these cases than of our uncomplicated recoveries and to many of us he seems thus unreasonably biased in his opinions on these matters. On the other hand most of us have seen cases developing unexpected asthma or bronchitis after nasal surgery and there does appear to be some relation as yet unexplained between the nose and the chest. Thus if the surgeon or anæsthetist has any doubt regarding the condition of the patient or his chest it is wiser to treat the case in conjunction with a competent chest physician. At times surgery should be undertaken under an antibiotic umbrella. It is useful to remember that asthma develops sooner or later in 15% of cases of vasomotor rhinitis and that there is always the risk that an operation on the nose may hasten its onset.

The nose and sinuses settle slowly after operation and the elimination of infection is gradual so that striking results should not be expected at once in either the nasal or the chest condition. Again it is by no means easy to decide in many cases just how much improvement has occurred, for some patients in gratitude to the surgeon hesitate to give a frank account of their post-operative conditions.

Cooke and Grove (1935) found sinusitis to be the ætiological factor in 92% of 248 cases of infective asthma of ten years' standing. 126 of these cases of asthma submitted to nasal surgery with 70% overall good results, 86% after complete operations but only 39% after incomplete operations. Fox and Harnad (1937) treated 150 cases medically with poor results but 60% of their cases were improved by radical ethmoidectomy and only 35% with intranasal ethmoidectomy.

It is difficult to predict which cases of asthma will improve after nasal surgery but as a reasonable number recover or are improved surgery should be considered in selected cases.

Universal agreement has not been reached as to why certain cases do not progress satisfactorily or in others the symptoms recur. It is possible that the whole of the focus of infection may not have been removed or a recurrence has taken place, surgery has altered the function of the nose, scar tissue has irritated the nasal nerves, or nasal polyposis and asthma may be one and the same disease.

My own routine of surgical treatment if the sinuses are clear on X-ray, or if in spite of the X-ray appearances antral wash-out is clear, is simple nasal polypectomy. If previous nasal surgery has been carried out and pus is found in the antra on wash-out in the presence of marked polyposis transantral ethmoidectomy may be undertaken.

A few details of operative technique should be mentioned:

Patterson's operation cannot be described as an easy one but experience in its use proves it to be of great value in the treatment of a difficult type of case.

Detailed attention to hæmostasis at every stage will render the operation more straightforward. Dr. A. C. Fraser, my anæsthetist, has found that the addition of a wetting or spreading agent to the cocaine solution used for posturing of the nasal cavity is of considerable value. The same solution in the form of foam is injected into the antral cavity early in the operation.

Suturing together of the eyelids has been found unnecessary. The less trauma to the soft tissues around the orbit the less the post-operative bruising and scarring later. Slicing of the skin as prac-

tised by Patterson is contrary to accepted plastic surgical practice and is better avoided. The skin is first incised only as far as the deep fascia, the incision being continued to its extremities with fine eye scissors, and the opening is then stretched wide with a pair of mosquito forceps. Traction on small artery forceps applied to the subcutaneous tissue and vessels exposes the deep fascia which appears dull and dry with the external angular vein showing through it. This vein and its small superior branch are either ligated or pushed outside the field. It is seldom necessary to use diathermy coagulation.

The fibres of the orbicularis muscle are separated to reveal the periosteum which is incised down to the bone immediately below the infra-orbital margin and elevated with the lacrimal sac. The periosteum along the medial $\frac{1}{4}$–$\frac{3}{8}$ in. of the infra-orbital margin at the attachment of the inferior oblique muscle is very adherent to the bone, but it is important to make particularly sure that this portion is well separated to facilitate removal of bone postero-lateral to the sac. The sac can then be pushed much farther laterally during the removal of the anterior ethmoidal cells as its lower attachment is freed.

Retractors have seldom been required, retraction being applied to the deeper portion of the muscle or periosteum by mosquito forceps. Occasionally if a better exposure has been needed for a short space of time Killian's speculum has been all that has been required.

On removal of bone anteromedial to the lacrimal sac a rectangular flap of nasal mucous membrane can be formed and turned medially and outward; its free margin is then secured by forceps. Later this will help cover some of the raw area deep to the suture line.

The nasopharynx should not be packed by the anæsthetist but left to form a reservoir in which blood may collect to lessen the frequency of nasal suction.

The use of a small motor-driven dental saw has been recommended for removal of the bone around the lacrimal apparatus but is dangerous and should not be used.

A pack of penicillin sulphathiazole paraffin paste on a gauze strip is placed in the nasal cavity and in the antral opening but not usually in the antrum itself. It is left in position for up to five days.

The muscle is brought together with fine catgut knotted on the inner or nasal surface and the skin is sutured with 0·003 in. tantalum wire which can be left in position several days without leaving a mark on the skin. The wound is splinted with a small collodion-gauze dressing and pressure applied for twenty-four hours around the orbit, avoiding the eyeball. The pressure dressing found most satisfactory is made up with a number of cotton-wool pledgets wrung out of a saturated aluminium acetate solution.

Complications are infrequent after Patterson's operation. The only notable ones seen after 81 operations were infection of the lacrimal sac in one early case, which infection settled with conservative treatment, and one case of damage to the nasolacrimal duct. In this latter case the lacrimal sac was opened (as in the Dupuy-Dutemps operation) by an H-shaped incision and the two flaps drawn outwards by sutures. In this case no post-operative symptoms related to the lacrimal apparatus occurred. In 4 cases the frontal sinus has been drained during the operation. Frontal sinusitis has not been encountered as a complication of the operation and there seems little doubt that if the ethmoid is adequately dealt with, in most cases the frontal sinus will take care of itself.

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Professor V. F. Lambert: Mr. Norman Patterson, a fortnight before he died, was kind enough to demonstrate his own operation to us on two patients suffering from nasal polypi. He made a special visit to Manchester for the purpose. This was typical of the man whose kindness and self-effacing modesty endeared him to us. The end-results of the operations he performed left nothing to be desired.

I regret that over the very small series of cases following his technique, I have not been able to repeat his successes. The operation falls down, where I think all ethmoidal operations fall down, in the unsuccessful clearing out of the anterior group of ethmoidal air cells which lie in the frontal process of the superior maxilla.

Mr. V. E. Negus said that he also had an affection for the late Mr. Patterson, but he felt impelled to make some criticisms of the operation under discussion.

He considered polyposis to be a generalized condition requiring medical treatment as well as surgical interference. The only symptom of uncomplicated polypi was obstruction to respiration or to drainage from the sinuses; consequently intranasal removal of polypi seemed adequate if combined with medical treatment. Calcium gluconate and dilute nitrohydrochloric acid were effective in some cases and in others zinc ionization was required.

When considering inflammatory conditions the first essential requirement was cure of infection in the maxillary sinus. If the lining were much degenerated the usual approach was through the canine fossa, with a clear view of the cavity, enabling the degenerated lining to be removed. In many cases it was only the lower half of the maxillary sinus that was affected, the mucosa in the upper half being sufficiently healthy to be left in position, thus allowing regeneration to be more easily accomplished.

The approach from above described by the openers seemed to be a most inconvenient one, and watching the operation as performed by Mr. Patterson had given the impression to the speaker that difficulties were being made which could be avoided by the more usual approach.

It seemed unusual and unnecessary to perform an external operation before the maxillary sinus had been adequately dealt with, because its cure often obviated the necessity for further surgery.

As an approach to the ethmoidal cells Mr. Negus was in favour of an incision starting below the eyebrow and curving round the inner margin of the orbit, well away from the canthus. The periosteum could be incised cleanly and elevated with the lacrimal sac and the attachment of the superior oblique muscle. If this method were adopted there was no interference with the contents of the orbit and the whole of the ethmoidal labyrinth, including the agger nasi cells, and in addition the sphenoidal sinus, could be clearly exposed and their walls removed where necessary. The base of the anterior fossa of the cranium was in clear view, so that removal of cells could be complete.

Approach to the ethmoid cells by the infra-orbital incision seemed an inconvenient method and one in which clean elevation of the orbital periosteum could not be accomplished because of the presence of the lacrimal sac and duct.

In many cases of infective sinusitis the frontal sinus was involved, and it was necessary, to get a cure, that the frontonasal duct should be enlarged and prevented from reclosing by the insertion of a skin graft.

Mr. Patterson originally recommended that a second incision round the margin of the orbit should be made if the frontal sinus needed attention.

Mr. Ogilvy Reid said he had watched Mr. Hargrove perform a demonstration Patterson operation about three years previously at a Shrewsbury Meeting of the Midland Institute of Otology and had become a convert to the procedure. Although not an easy operation it certainly was a convenient approach to the regions involved in chronic nasal polyposis. It was wrong to regard it as an operation on the antrum, as this sinus was really only traversed *en route* to the ethmoids and nose. It was, however, an advantage to be able to deal with antrum disease at the same time and he had found no difficulty in doing this adequately from above. He added that it was always advisable to look up the nose at the end of the operation, as it was sometimes most disconcerting to find a polypus still present there at the end of an extensive ethmoidectomy!

Mr. F. C. W. Capps said that he would also wish to pay tribute to the memory of the late Mr. Patterson. As to his operation Mr. Capps had not found it a satisfactory approach to the problem, or any improvement on the other well-established methods.

As Mr. Capps saw it this operation should be reserved for cases of suppurative ethmoiditis. In his experience this state of affairs was never present without fairly gross antral infection and it was probably more important to clear up this side of it than to concentrate entirely on the ethmoidal gallery. He had never found the approach from above a satisfactory way of dealing with antral sepsis. If, however, the antral sepsis was dealt with from below by a Caldwell-Luc operation, the ethmoids could also be dealt with quite easily transantrally. If external approach was necessary the old-established incision starting below the supra-orbital ridge and passing down on the inner side of the inner canthus gave in his opinion a safer and more adequate approach. The great advantage claimed for the Patterson approach was that it dealt with the anterior ethmoidal group which was not so easy to approach intranasally or through the antrum. It had, however, been his experience that even after the Patterson operation recurrence of trouble took place and it was always in the anterior ethmoidal group. Another point worth considering was the fact that by the Patterson approach the bony surgery often involved the very dense nasal process of the maxilla and trouble had occurred on several occasions with a recurrent osteitis or osteomyelitis in this area. This seemed far less likely to occur when the antrum was approached through the canine fossa or the ethmoid approach was limited to the thin orbital plate.

Mr. Leslie Thomas thought the Norman Patterson operation gave the best mode of access to deal with those cases of polypi requiring radical surgery. Some prefer to approach the ethmoid and antrum from above and others from below.

He suggested an additional approach through the canine fossa. In his early cases of the Norman Patterson operation, which he found excellent for dealing with polypi in the anterior ethmoidal region especially those in contact with the lacrimal sac, he found difficulty in dealing satisfactorily with the anteromedial angle of the antrum. By entering also through the canine fossa, preferably by an oblique incision, the antrum was easily cleared and an inferior meatal window made. This method met the

objection raised by Mr. Simpson Hall and also conformed to one of the principles of surgery, namely good access and visualization of the field of operation. One could inspect the region from three angles through the incision above, the anterior naris below and the canine fossa laterally. He had found this additional approach made a difficult operation less difficult.

Mr. I. B. Thorburn remarked that in patients with polypi it was often necessary to do a Caldwell-Luc operation. If, on removing the diseased antral mucous membrane, unhealthy ethmoid cells were uncovered on the upper medial wall it was his custom to extend the operation to a transantral ethmoidectomy. This gave excellent access to posterior ethmoid and sphenoid. The inaccessible anterior ethmoid cells could be cleared by an ordinary intranasal approach. He thought that by using this extended Caldwell-Luc operation an external operation could often be avoided.

Mr. S. W. G. Hargrove (in reply to Mr. Negus) said that he found the approach to the ethmoid by the infra-orbital incision gave him good results and no doubt Mr. Negus obtained the same results by the supra-orbital approach. He found no difficulty in removing the fronto-ethmoidal cells, and making a complete removal of the polypoidal ethmoid labyrinth. He also found no difficulty in removing the mucosal lining of the antrum from above. He believed that the primary source of infection was in the ethmoid, and that in chronic polyposis with infection the antrum was secondarily infected. The frontal sinus, if involved in the infection, was able to drain after removal of the infected ethmoid, and in his series there was no instance in which he had to perform a frontal operation. The frontonasal duct should not be disturbed and this had been shown experimentally by Walsh (1943), who investigated the effects of interference of the frontonasal duct in dogs, and studied the pathological changes in the frontal sinus:

(1) He enlarged the frontal ostium and nasofrontal duct, without interference with the mucosa of the rest of the frontal sinus.

(2) He removed the mucosa of the frontal sinus with enlargement of the ostium and of the nasofrontal duct.

(3) He removed the mucosa of the frontal sinus to within $\frac{1}{4}$ in. of the ostium without interference with the ostium or the nasofrontal duct.

The results in (1) and (2) were impaired drainage with chronic infection, whilst in (3) there was no impairment of drainage of the frontal sinus, with regeneration of the mucosa. Mr. Negus said that the removal of the medial antral wall above the inferior turbinate would interfere with drainage—in the series described, in no instance had the antrum had to be drained or washed out to remove infection. The elevation of the orbital periosteum could be easily performed, and he found that the lacrimal sac and duct caused no inconvenience.

In reply to Mr. Capps he said that he had operated on cases of suppurative ethmoiditis, but the results were not as good as the cases of suppurative ethmoiditis with polyposis. He found no difficulty in removing the anterior ethmoidal cells by the Norman Patterson approach. He had no instances in which a recurrent osteitis had occurred in the frontal process of the maxilla.

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Mr. M. Spencer Harrison, in reply, said that good exposure of the agger nasi cells was possible by the Patterson approach to the ethmoidal sinuses and in his experience frontal sinusitis had not occurred as a complication of the operation either early or late.

The prolapse of orbital fat into the operation area was usually due to unsatisfactory separation of the periosteum especially that lateral to the lower lacrimal sac. The dissection here was difficult but most important as it was necessary to remove bone to allow the sac and duct to be pushed laterally to give the excellent exposure of the anterior ethmoidal labyrinth for which the operation was designed.

It was better to make scratch marks and cross scratches before the injection of the adrenaline solution into the soft tissues, and if care was taken no great difficulty should be found in carrying out the soft tissue work almost bloodlessly.

No operation upon the ethmoids had been designed which would remove all the cells in every case and failures occurred in Patterson's operation as in others. Also it must be remembered that polypi might arise from the nasal septum and other parts of the nasal mucosa.

Section of Anæsthetics

President—Professor R. R. MACINTOSH, M.A., D.M., F.R.C.S.Ed., F.F.A. R.C.S., D.A.

[*May* 7, 1954]

The Role of the Anæsthetist in the Management of Intractable Pain

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THE management of intractable pain is at times a difficult clinical problem which taxes the diagnostic acumen and therapeutic skill of the physician. Not infrequently solution of this problem is only possible by the concerted effort of the patient's doctor and a number of specialists who contribute their individualized skill toward a common goal. Among this group is the anæsthetist, who is often requested to lend his knowledge and technical skill to aid in the diagnosis and therapy. In view of the fact that in some quarters there are differences of opinion as to what can be contributed by the anæsthetist to the solution of this problem, it may be of benefit to discuss the proper role of this specialist in the management of intractable pain.

During recent years a great deal of interest has been shown by anæsthetists in the management of pain not associated with operations. A number of publications advocating and/or reporting the formation of " nerve block clinics" or " pain clinics " have appeared in the medical literature. Some of the authors (Dittrick, 1950; Ruben, 1951) have suggested that the anæsthetist, of all physicians, is particularly well qualified to undertake the control of pain because in his daily work in the operating room he deals directly and inevitably with pain and its prevention. As expressed by one outstanding anæsthetist, "there is no other field of medicine more ideally suited to carry on the therapy of pain than ours" (Haugen, 1953). These reports have led uninformed anæsthetists to believe that they have special abilities and aptitudes to manage patients with intractable pain. While it is true that the anæsthetist has certain attributes which may make him fit to make significant contributions toward the solution of the problem, it is important that he be cognizant of the great differences between individual technical procedures for the prevention of pain perception and the broad general problem of the management of a patient with serious pain. The latter implicates total or ultimate management of a case and requires many special qualifications and attributes which will be discussed subsequently.

The role of the anæsthetist in the management of intractable pain may be one of two categories: (1) As a provider of special technical aid which may serve to promote the over-all management by diagnostic or therapeutic procedures; (2) as the individual who is responsible for the over-all management of the patient. In most instances he will be in the first category and will act as a consultant whose contribution will, of necessity, be an exercise rather than a discipline, since the procedures he can offer are inherently limited in their place among the many things which must be done for most patients with severe intractable pain.

The anæsthetist has a number of special attributes which make him a valuable colleague. His everyday experience with depressant drugs, particularly the analgesics and sedatives, make him acutely aware of the definite limitations and disadvantages of, as well as complications from, the use of these medicinals. This knowledge and experience make him a particularly useful consultant in the management of this phase of therapy. In addition, he has or should have developed exceptional skill and dexterity with nerve block procedures to interrupt pain pathways for surgical operations, and although proficiency in this method for surgical anæsthesia does not necessarily insure success when they are employed to control non-surgical pain, it is a great asset. Finally, the anæsthetist in his daily practice sees and cares for patients who fear pain and consequently he naturally develops a sympathetic understanding, a considerate feeling and patience for those who suffer. This is, without doubt, the most important and greatest single qualifying attribute.

All of these are commendable qualifications, to be sure, which, though important, are not sufficient to make the anæsthetist specially qualified in managing the over-all problem. This is

because management has many ramifications and requires a thorough knowledge of the patient and his problem. It may entail many unusual diagnostic procedures involving neurological, radiological, laboratory and various other data which must be properly integrated and interpreted. Moreover, the case may involve definitive therapeutic and rehabilitative measures which may be outside of the sphere of anæsthesiological practice. Furthermore, it is necessary for the physician who assumes the important responsibility of managing patients with a pain problem to be willing to devote a great deal of time and effort, more than many doctors are willing to spend, to the solution of the problem. Finally, he must have a special knowledge for pain mechanisms together with training in the general manifestations of painful states and their characteristic patterns. It is perhaps unfair to expect the anæsthetist to assume such diversified duties and responsibilities, but if he is that rare individual who has these special attributes together with the tenacity to face repeated discouragement, he may qualify for the position as the over-all manager of the patient with intractable pain.

Requisites for Optimal Results

Regardless of which category he may find himself, the anæsthetist can contribute significantly to this problem *only* if he observes certain important requisites.

Perhaps the first and one of the most important is that he must assume responsibilities and discharge obligations as a physician rather than act merely as a technician who is an expert in inserting needles. Even in the cases where he is acting as a consultant skilled with nerve blocks, it is important that the anæsthetist have an insight into the problem.

It is essential for the anæsthetist to make, confirm or reject the diagnosis, even when he is acting in the capacity of a consultant. Even if the diagnosis is obvious, it is advisable to investigate the problem fully because in some cases additional information may be obtained that will aid him in performing his task better. To accomplish this, a detailed history and thorough physical examination are essential together with knowledge of pain syndromes and the underlying mechanism. Taking the history will afford the physician the opportunity to become acquainted with the patient, to investigate his personality, and, what is most important, to establish rapport with him and win his confidence—factors which are so important in the management of any patient, but particularly those with intractable pain.

At this juncture it is important to interject a few words regarding the responsibility of the anæsthetist or any other consultant, to the patient's physician. Since the success of the over-all management of the patient with chronic pain in a large measure depends upon his unswerving confidence in his personal physician, it is the duty of all consultants not to say or do anything which will cause deterioration of that confidence.

Once a diagnosis has been made, it is necessary to determine whether nerve blocking is indicated. It is important to employ this method in indicated cases only, for, unless the haphazard and careless selection of patients is avoided, the results will be poor and the method will come into disrepute. If nerve blocks are indicated, it is necessary to decide what is to be accomplished with the procedure, that is, whether it is being performed for diagnostic, prognostic or therapeutic purposes.

It is also necessary to inform the patient about the various phases of the nerve block management. The purpose of the block, the general outline of the procedure, the effects that may be expected, what may be accomplished and what is being sought must be clearly explained to the patient. If it is explained beforehand that the initial block may not produce the desired effects and that several blocks may be necessary before the efficacy of the method can be determined, the patient is less likely to become discouraged before all the treatment has been completed. The necessity for his co-operation should be particularly emphasized, for an informed patient is likely to be a co-operative patient. Throughout his discussion, the anæsthetist must demonstrate full confidence in his method of management; for, unless the physician believes in the method himself, the results will be uniformly poor no matter how effectively the pain pathways are interrupted. Alexander (1954) has found that more than 60% of all patients who are blocked for pain derive an appreciable degree of relief provided the operator is sincere in his attempt to give the patient relief.

Experience with the block procedure to be employed and a familiarity with the drugs which are suitable for a particular case are important. Nerve blocks must be performed carefully and correctly with meticulous attention to anatomical detail and with utmost skill and gentleness. The practitioner should be fully acquainted with the structures that are traversed by the needle and the complications inherent in such procedures. It is essential to localize exactly and precisely the involved nerves and to employ small amounts of solution. Thus, while for therapeutic purposes in most instances a large amount of solution can be used without affecting the result of the block, such large amounts will spill over and affect other nerves and are, therefore, contra-indicated in diagnostic or prognostic procedures.

During and following nerve blocks, the results must be carefully assessed by observation of the reaction of the patient to the formation of the intracutaneous wheal, to the insertion of the needle through pain-sensitive structures, and to paræsthesia. When the adequacy of the block procedure is established, the pain-relieving effects require observation from a few hours to several days or weeks. The amount, type, and duration of relief obtained should be recorded.

The nerve block method of managing intractable pain has certain limitations and is not completely innocuous. Chemical neuritis and neuropathy with paralysis can occur, and accidental pneumothorax, total spinal anæsthesia, circulatory and respiratory collapse, and even death have been reported (Pallin and Deutsch, 1951).

Nerve blocks, in most instances, contribute only a small part to the total solution of the problem and are thus to be considered only as an adjunct to other methods of therapy. The formation of a true *Pain Clinic* and the active participation of the anæsthetist in such a group would be of great value. It should be under the direction of a highly-trained individual familiar with all phases of pain and its management. The team should include a neurologist, a neurosurgeon, a psychiatrist, an internist, an orthopædist, a radiologist, and a physiatrist, in addition to the anæsthetist. This group can review difficult diagnostic and/or therapeutic pain problems and thus act in a consulting capacity.

Technical Considerations

No attempt will be made to discuss techniques except to point out that any nerve capable of transmitting pain can be injected chemically to interrupt its conduction. Physicians who assume the responsibility of executing these blocks for the management of non-surgical pain should become skilful and dexterous by first performing them repeatedly for surgical anæsthesia.

Adjuvant methods include the use of rœntgenograms to assist in the proper placement of needles with or without prior injection of contrast media to indicate diffusion of the analgesic solution (Alexander and Lovell, 1952).

Usually aqueous solutions of a local anæsthetic are employed. If repeated or continuous injections of such agents fail to produce permanent relief, long-acting agents such as phenol and ethyl alcohol may be used (Mandl, 1950) but these are neurolytic agents and may produce neuritis and neuropathy. The same may be said of Efocaine. Oil solutions and ammonium compounds have been almost entirely useless in our hands.

Role of Nerve Blocks in Pain Control (Bonica, 1953*a*)

The term *neuralgia* denotes pain of any type having a segmental or peripheral nerve distribution. It is usually the symptomatic expression of an inflammatory, circulatory, toxic, degenerative, metabolic or neoplastic neuritis. Therefore, it is important to ascertain the cause of the neuralgia and, if possible, to remove it. In most instances nerve blocks are valuable only as diagnostic or prognostic aids, or as a therapeutic measure in selected patients with certain types of neuralgia. Alcohol block is an accepted therapeutic procedure for the management of tic douloureux and superior laryngeal neuralgia. Occipital neuralgia often responds well to repeated injections of the affected nerves. In certain cases of cervicobrachial neuralgia repeated blocks produce prolonged and even lasting effects, particularly in the case of scalenus anticus syndrome. Repeated paravertebral or intercostal block or continuous segmental peridural block is of value in cases of post-infectious or post-traumatic segmental or peripheral neuralgia involving the thoracic, lumbar or sacral nerves. If the neuralgia is due to degenerative or traumatic pathology of vertebral column, blocks are effective in controlling severe pain during conservative management or while the patient is being prepared for surgery.

Causalgia, of the major type, is almost always relieved temporarily with sympathetic blocks which should be done as diagnostic-prognostic procedures prior to sympathectomy. Occasionally repeated blocks produce lasting relief, especially if they are done early. Repeated or continuous sympathetic blocks can be considered as the primary therapeutic measure in managing minor causalgia, post-traumatic pain syndrome, post-traumatic osteoporosis, the shoulder-hand syndrome and other minor reflex sympathetic dystrophies. When phantom limb is associated with a burning pain, sympathetic blocks may produce lasting relief. In other instances block of the pain pathway at various sites should always be done prior to neurotomy, rhizotomy or chordotomy, when these are contemplated, in order to predict their effect.

Peripheral vascular diseases are often accompanied by pain which may be relieved with nerve blocks. These procedures are particularly useful in patients with acute circulatory deficiencies due to vascular spasm as obtains after an injury and in frost-bite and thrombophlebitis. In these cases continuous sympathetic block produced via the peridural route is the most effective in relieving pain, œdema and aborting complications. These should be initiated before anticoagulant therapy is begun lest a hæmorrhage is started during the introduction of the needle. In chronic disorders with a vasospastic element such as Raynaud's disease and thromboangiitis obliterans, sympathetic blocks should be used only to predict the effect of sympathectomy. Temporary blocks are of little prognostic value in degenerative diseases such as arteriosclerosis, because maximal beneficial effects following sympathetic interruption sometimes do not become apparent for weeks or even months. Therefore, a negative response to the block does not indicate that the patient will not derive benefit from the operation. In patients with chronic disorders, who refuse or cannot tolerate an operation, chemical sympathectomy produced with phenol or alcohol is an excellent substitute (Bonica, 1953*a*; Haxton, 1949).

Pain of visceral disease, in special circumstances, may best be relieved with nerve blocks. These procedures are indicated when the pain is severe and intractable, as occurs in moderate pulmonary embolism, intractable angina pectoris, and aortic aneurysm, all of which can be relieved dramatically with cervicothoracic sympathetic blocks. The pain of pleurisy can be relieved with intercostal nerve blocks. The intense pain of acute pancreatitis can be relieved by continuous segmental peridural block or blocking of the cœliac plexus, or the paravertebral sympathetic ganglia. These procedures, in addition to the relief of pain, improve the patient's condition by releasing the visceral vasospasm. The severe pain of gall-bladder colic, renal colic and other visceral pain can be temporarily relieved by similar procedures.

Musculoskeletal pain associated with such conditions as ankle and other joint sprains, fractured ribs, fractured vertebræ, painful hip, acute torticollis, low back pain, painful shoulder, bursitis, tendinitis, periarthritis, and acute myalgias can be permanently relieved by repeated blocks using solutions of local anæsthetics. This method of therapy affords sufficient pain relief to allow active mobilization and the use of physiotherapeutic measures and thus enhances a rapid improvement. In acute myofascial disorders with trigger areas, injection of a small amount of a local anæsthetic solution often produces dramatic relief of pain and aborts what is usually a long-lasting disability. In order to obviate the disadvantages of narcotics in severe post-operative pain, repeated intercostal blocks, or better still, continuous segmental peridural blocks may be done with solutions of longer acting agents such as pontocaine or nupercaine and may thereby prevent post-operative pulmonary complications.

The excruciating pain that is sometimes present in *inoperable or recurrent cancer* may be adequately relieved with nerve blocks, which, in certain instances, offer advantages that may not be had with other forms of management. Properly executed nerve blocks can effect complete relief of pain and enable the sufferer to tolerate more intensive X-ray and radium therapy and other forms of medical treatment that would not ordinarily be tolerated. In the majority of *poor risk* patients with intractable pain from inoperable malignant lesions, alcohol nerve blocking is the method of choice, since it obviates the disadvantages and complications of narcotic therapy and neurosurgical operations. In a group of 137 patients with severe intractable pain associated with cancer treated with prolonged nerve blocks, 64% obtained complete relief until they died, 23% obtained moderate relief, and 13% obtained only minimal or no relief (Bonica, 1953*b*). These statistics compare very favourably with neurosurgical operations (Grant, 1943).

SUMMARY

The management of intractable pain is a difficult clinical problem which may require the joint effort of several physicians in various fields. The anæsthetist or any other physician who is proficient in executing analgesic blocks can play a significant role in the management of patients with intractable pain. A correct diagnosis, an understanding of pain mechanisms, knowledge of the anatomy and neurophysiology of pain, thorough skill and knowledge of the techniques and agents best suited for various analgesic blocks, and an objective assessment of the results are important requisites. Without these optimal results cannot be obtained. The value of analgesic blocks in the management of various pain syndromes is discussed.

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Wasp Venoms and Anæsthesia

By E. H. SEWARD, D.M.

THERE are two sorts of wasp, the social wasp and the solitary or hunting wasp. The social wasps are so-called because they live in communities and are familiar by virtue of their anti-social behaviour: their sting is purely defensive and if they kill other insects they usually do so by biting them. The solitary wasps are not so well known because in the ordinary way they do not come in contact with man and they are seldom seen unless one is looking for them. There are hundreds, probably thousands, of varieties, and common to them all is the power of paralysing certain other insects by stinging them

Only the female can sting: she finds the prey and stings it when she is ready to lay her eggs. The prey is affected almost at once and is then taken by the wasp to a safe place where she lays her eggs on it or near it. When the grubs hatch out in the course of time the victim is still alive though paralysed, and provides fresh meat for them to feed on.

This process was first described by Dufour over a hundred years ago (Dufour, 1841): he thought the prey was killed by the sting and that the venom acted like an antiseptic. Then half a century later the famous entomologist J. H. Fabre of Avignon observed that, in fact, the prey is paralysed: the muscles can on occasions contract if given a stimulus: gut activity continues and the insect lives in a vegetative state. Fabre studied closely the behaviour of many different species and recorded in detail his observations between the years 1879 and 1907 (Fabre, 1916). He noted that the wasps are selective over their prey, that one species always stings the same prey. From a study of behaviour and taking into account the attitude of the wasp when stinging and its relation to the anatomy of the prey, he concluded that a wasp always stings its prey in a nerve centre and that it knows where to sting. If this is true it suggests that the venom might act like a local analgesic drug. Subsequently, others (Marchal, 1897; Rabaud, 1917) observed that paralysis is just as rapid wherever the wasp inserts its sting and it is now thought, though not absolutely proven, that the sting is passed through the skin of the prey at any weak or convenient point. These wasps are usually accurate and reliable with their stings but sometimes the effect is only partial, and rapidly wears off (Fertan, 1901).

Wasps belong to the group of Hymenoptera of which there are many families. The species of hunting wasp may be considered in terms of the prey which they hunt. Thus: *Ammophila* hunt caterpillars; *Cerceris* hunt beetles and bees; *Sphex* hunt grasshoppers, crickets, mantis; *Bembex* hunt flies; *Pompilus* hunt spiders; *Aphilanthopus* hunt ants. There is one wasp called *Scolia*, whose habits would appeal to anæsthetists. It preys on a beetle called *Anoxia*, which is akin to the cockchafer.

The prey is not always harmless. For instance one *Pompilus* wasp attacks a tarantula spider which is of about equal strength, well armed, and larger, and does not submit meekly without a struggle. And there is one family, a wasp with wingless females, which attack the fierce larva of the tiger-beetle: this larva lives in a burrow and the wasp has to allow itself to be caught and stings the larva only at the last moment when it is lifted up before being dragged down the burrow. The wasps do not always win these conflicts, in which they rely on their agility and the powerful venom with which they are armed.

Though the behaviour of solitary wasps has been quite extensively studied, the toxicology and pharmacology of their venom has received little attention. Recently Beard in America has made a detailed study of the venom of *Habrobracon* (Beard, 1952). This is a small wasp about 0·5 cm. long and hence the amount of venom it carries is very small indeed, but it is convenient for study because it is easily reared in captivity. The prey is the larva of *Ephestia* or *Galleria*, which resembles a white caterpillar about 2–3 cm. long. The information obtained by this study indicates how much can be learned from so little.

With prey of *Habrobracon* ganglionic stinging is neither likely nor necessary and it is able to paralyse the prey by stinging it at any place. The venom when used by the wasp is extremely potent; it produces a prompt paralysis from which there is no recovery. Ordinarily the wasp does not maintain its stinging position for any length of time which suggests that the dose of venom is injected almost at once and not continuously pumped into the prey. The injected venom is transported by the blood because extracts from the poison glands injected parenterally into *Galleria* larvæ result in paralysis, and blood taken from a paralysed larva will paralyse another larva if injected into its body cavity. Blood transport of the poison is confirmed by experimentally ligating larvæ and injecting venom on one side of the ligature. Paralysis appears only on the side of the ligature where venom was injected; if the ligature is cut blood flow is restored between both body regions, and the unparalysed portion of the larva becomes paralysed. Blood from a paralysed larva can induce paralysis when injected into a second larva, and blood from this can induce paralysis in a third larva. On rare occasions the transfer can be carried out to a fourth larva, these manœuvres representing considerable dilution of the venom. The *Galleria* larva is a thousand times or more the size by weight of an adult *Habrobracon* wasp. Beard calculated that the venom concentration in the blood of a paralysed larva is less than one part per million, that one part in 200 million is sufficient to cause a permanent paralysis, and smaller quantities can cause a temporary paralysis. There is nothing to suggest that the venom is self-propagated in a virus-like manner. As a result of tests with diluted venom, he observed that the lower the concentration in the blood the greater is the delay in onset of paralysis, the less reliable the paralysis and the more rapid is the recovery from it.

The ligature tests already mentioned demonstrate that segmental tissues rather than single organs are affected by the venom. It has been assumed, largely as a result of behaviour study, that the venoms of wasps are neurotoxic and one worker (Hartzell, 1935) has presented histopathological evidence that ganglia in crickets paralysed by the sting of a *Sphex* showed characteristic lesions. Others (Richards and Cutcomp, 1945) on the other hand have observed that such changes can be the result of autolysis associated with a general degenerative condition of the animal and do not necessarily indicate a specific action on the ganglion.

In general, pharmacological methods of study of neuromuscular function in insects are not satisfactory, but electrophysiological tests have been more informative. Beard used fine tapered silver electrodes for recording and stimulating, the recording electrodes being connected through a pre-amplifier to an oscillograph and loud-speaker. If, in the larva, electrodes are placed on the nerves leading from ganglia to body-wall muscles, spontaneous nerve potentials are observed in normal and in paralysed larvæ. If these nerves are stimulated the muscles in the normal larva respond by contraction but in the paralysed larva fail to contract, which suggests that the site of action of the venom is at the neuromuscular junction. Since the mechanism of neuromuscular transmission in insects is unknown it is difficult to suggest what may be the mode of action of the venom.

The position at present is that in the one wasp studied fully there is evidence that paralysis produced by its venom is due to action at the neuromuscular junction. It seems likely therefore that the venom of other wasps acts in a similar way. Curare does not produce paralysis in insects tested so far but the effect of depolarizing drugs which produce paralysis in vertebrates has not been studied.

Hunting wasps are selective over their prey and their venom is usually only effective in producing paralysis in their ordinary prey. The specificity suggests subtle biochemical differences among both wasps and prey. Furthermore, some wasps habitually produce a temporary, reversible paralysis whereas other produce a paralysis from which there is no recovery, which suggests that factors other than dosage are concerned.

The extent of knowledge so far is that the venom is either a protein or protein-like material, is water-soluble and occurs in the plasma portion of the blood. Further identification must be only a matter of time, for recently Jaques and Schachter (1954) have analysed the venom of the common social wasp, *Vespa vulgaris*, and found that it contains histamine in high concentration, 5–hydroxytryptamine and a potent unidentified smooth muscle stimulant.

In conclusion, it is well to know that we are not the only members of the animal kingdom with the power to paralyse other creatures. For us it provides a livelihood. The wasps depend on this power for their very lives and the survival of the species and they produce an effect of considerably longer duration. It is intriguing to speculate that perhaps the drugs they use may be effective and of value in man, but there is as yet no ground for more than speculation.

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Section of Pædiatrics

President—C. T. POTTER, M.D., F.R.C.P.

[*April* 23, 1954]

MEETING HELD AT THE QUEEN ELIZABETH HOSPITAL FOR CHILDREN, LONDON

CASES and material of interest were displayed in four main groups:

A. WARD DEMONSTRATION: Individual Cases

Thyrotoxicosis and Exophthalmos Treated with Neomercazole.—Mr. J. MINTON.

Albers-Schönberg Disease: 5-Year Follow-up Including Hæmatological Trends.—Dr. R. J. CREMER (for Dr. U. SHELLEY).

Galactosuria with Mental Deficiency.—Dr. P. R. CLAY (for Dr. C. T. POTTER).

Fibrocystic Disease of Pancreas with Cirrhosis of Liver.—Dr. E. H. BACK (for Dr. J. N. O'REILLY).

Dextrocardia Associated with a Vascular Ring.—Dr. P. COLE (for Dr. N. M. JACOBY).

Goitrous Cretinism with Failure of Thyroxin Synthesis.—Dr. A. D. JACKSON (for Dr. R. H. DOBBS).

Pulmonary Stenosis in 2 Siblings.—Dr. H. T. COLES (for Dr. H. AVERY).

Papulo-necrotic Cutaneous Tuberculides Associated with Primary Pulmonary Tuberculosis.—Dr. E. H. BACK (for Dr. O. GOTCH).

Two Cases of Primary Cutaneous Tuberculosis of Face and Buttocks.—Dr. E. H. BACK (for Dr. J. N. O'REILLY).

Sprengel Shoulder.—Dr. J. A. LYONS (for Mr. H. W. S. WRIGHT).

Eosinophil Granuloma of Bone.—Dr. M. MISTRY (for Mr. E. T. BAILEY).

B. SPECIAL DEPARTMENTS

Pathology

(i) **Micro-methods of Laboratory Investigation.**—Dr. B. LEVIN.

(ii) **Morbid Anatomy Demonstration:**

(*a*) **Vascular Compression Rings:** (*b*) **Erb's Palsy and Diaphragmatic Paralysis:** (*c*) **Massive Pulmonary Hæmorrhage in the Newborn.**—Dr. N. E. FRANCE.

Radiological

(i) **Peribronchial Changes in Respiratory Infections.**—Dr. C. J. HODSON.

(ii) **Radiological Appearances of the Small Bowel in Cœliac Disease.**—Dr. E. M. HOWARTH.

(iii) **Radiological Appearances in Megacolon and Hirschsprung's Disease.**—Dr. B. C. H. WARD.

C. WALL DEMONSTRATIONS

The Value of Antibiotics in Gastroenteritis.—Dr. L. HAAS (for Dr. R. H. DOBBS and Dr. IAN M. ANDERSON).

Chloramphenicol Palmitate in Whooping Cough.—Dr. D. MORRIS.

D. OUT-PATIENT DEMONSTRATION

Metabolic Disorders Associated with Renal Dysfunction:

(*a*) **Renal Acidosis.**—Dr. W. F. YOUNG (for Dr. C. T. POTTER).

(*b*) **Hypercalcæmia Showing Response to a Low Calcium Diet: Two Cases.**—Dr. ALEX. RUSSELL and Dr. W. F. YOUNG (for Dr. N. M. JACOBY and Dr. R. H. DOBBS). (*See* pp. 1036.)

(*c*) **Hyperelectrolytæmia of Unknown Ætiology.**—Dr. G. BOSS (for Dr. R. H. DOBBS).

(*d*) **Hyperphosphaturic Rickets: Three Cases. Calcium and Phosphorus Balances Before and During Treatment with Vitamin D.**—Dr. J. RUBIE (for Dr. R. H. DOBBS).

(*e*) **Fanconi Syndrome without Acidosis or Evidence of Renal Damage.**—Dr. J. STAVERT (for Dr. H. M. M. MACKAY).

Syndrome of "Intra-uterine Dwarfism": Five Cases from Age 18 months to 8 Years.—Dr. ALEX. RUSSELL. (*See* pp. 1040.)

Intersexuality in Infancy: Male and Female Examples. Management of Adrenogenital Female Form with Cortisone and Salt Alone.—Dr. ALEX. RUSSELL.

Bilateral Adrenocortical Atrophy: Confirmation by Retroperitoneal Pneumography. Management Over Four Years.—Dr. ALEX. RUSSELL (for Dr. C. T. POTTER).

Medical Conditions Confined to One of Uniovular Twins (Four Pairs of Twins).—Dr. J. R. K. HENRY (for Dr. R. H. DOBBS).

(i) **Hiatus Hernia**; (ii) **Congenital Morbus Cordis**; (iii) **Cœliac Disease**; (iv) **Diencephalic Syndrome of Emaciation.**—Dr. ALEX. RUSSELL.

4 pairs of twins were shown, one of each pair having one of the above conditions. Monozygosity was established by a study of identity of blood groups and palm prints which, between them, gave a probability of monozygosity of over 95%.

[*continued overleaf*

Spontaneous Remission in Cavernous Hæmangiomata (5 Cases).—Mr. R. J. V. BATTLE.

Congenital Dislocation of the Hips.—Mr. J. C. R. HINDENACH.

Demonstration of General Management and Physiotherapeutic Methods in 4 Cases of Cerebral Palsy.—Dr. U. SHELLEY, Miss N. R. FINNIE and Dr. D. C. ARNOTT.

Neonatal Obstruction (3 Cases).—Dr. M. THORNHILL (for Mr. V. A. J. SWAIN).

Severe Idiopathic Infantile Hypercalcæmia. Long-term Response of 2 Cases to Low Calcium Diet.—ALEX. RUSSELL, O.B.E., M.D., M.R.C.P., and WINIFRED F. YOUNG, M.A., M.D. (for N. M. JACOBY, M.R.C.P., and R. H. DOBBS, F.R.C.P.).

The clinical syndrome associated with hypercalcæmia in infancy has recently been defined in two forms. Anorexia, vomiting, constipation, hypotonia and failure to gain are common to them both, but in one with good prospects of spontaneous recovery (Lightwood, 1952) only biochemical changes, hypercalcæmia and azotæmia, have been found in association with them. In the other, these changes have been linked with, although not believed responsible for, additional manifestations including widespread skeletal pathology, a typical cranio-facial appearance, severe mental and physical retardation and other anomalies (Fanconi *et al.*, 1952) from which recovery seemed highly improbable. As more cases have come under observation, however, apparent gradations between these two forms have emerged which, even if severely affected, lack some of the features of the two examples of Fanconi *et al.*

The essential changes in both mild and severe gradations of the syndrome may well be regarded as due to the same pathogenic process associated with hypercalcæmia. The symptomatology in both is typical of that related to hypercalcæmia in adult hyperparathyroidism and hypervitaminosis D. The combination of skeletal changes and cerebral impairment in the severe forms is analogous to that produced by hypervitaminosis D, and may thus derive from this or from some similar metabolic or toxicological disturbance, probably operating pre-natally. "Osteosclerotic" processes concentrated within long-bone metaphyses could retard general skeletal growth, while those involving the cranial base, especially sphenoidal segments, could impede growth of the nasal bridge and frontal bone to produce the typical cranio-facial appearance. Of the anomalies described by Fanconi *et al.* (1952) only the presumptive congenital heart lesion, the strabismus and the hypercholesterolæmia, cannot be related to such a single pathological process. These are not constant findings and were, in fact, absent from the two cases presented in this report.

Rationale of low calcium diet.—The rational treatment for a disorder associated with hypercalcæmia is a low calcium diet, provided that a negative calcium balance, such as is characteristic of hyperparathyroidism, has been excluded. Although in earlier accounts of a similar clinical pattern associated with hypercalcæmia in infancy (Anspach and Clifton, 1939; Pratt *et al.*, 1947; Philips, 1948) the authors attributed the disturbance to primary hyperparathyroidism, objective proof of this was lacking, the diagnosis being based mainly upon the close clinical parallels with adult hyperparathyroidism. Pratt *et al.* acknowledged the discrepancy in their case of the absence of the hypercalciuria and the negative calcium balance essential to parathyroid overactivity, findings also lacking from the few more recent cases of "idiopathic" hypercalcæmia in which they have been sought. A photograph of Anspach and Clifton's case emphasizes the analogy in revealing cranio-facial features identical with those noted by Fanconi *et al.*

A low calcium diet is known to be effective in several hypercalcæmic states. But in *primary hyperparathyroidism*, a reduction in calcium intake is usually contraindicated since it would worsen an already adverse calcium balance and intensify osteoporosis. When, however, serum phosphorus and N.P.N. levels are rising rapidly and renal failure is imminent, the temporary use of a low calcium diet is justified to reverse this trend and has been applied with good results (Albright and Reifenstein, 1948). In adults suffering from *hypercalcæmia without hypercalciuria* induced by prolonged and excessive intake of milk (calcium) and alkalis, response to a low calcium diet was prompt (Burnett *et al.*, 1949) clinical symptoms being relieved as both serum calcium and blood urea levels fell to normal. A similar response may also follow reduction of calcium intake in hypervitaminosis D. Hence attempts to reduce abnormal serum calcium concentrations in idiopathic hypercalcæmia by lowering the calcium intake can be regarded as both safe and logical.

Direct relationships between the symptomatology and the hypercalcæmia (repeatedly demonstrated in adult hyperparathyroidism) have yet to be established in this infantile syndrome. It is true that identical symptoms are linked to the hypercalcæmia of vitamin-D intoxication in infancy, but they are also met with in the absence of raised serum calcium levels in the infantile syndrome of "medial arterial calcification" (Baggenstoss and Keith, 1941; Hild, 1942). The biochemical and clinical response to a low calcium diet could be expected to produce evidence on this point.

The immediate and long-term response of 2 infants with the severe form of idiopathic hypercalcæmia to relatively short periods of a low calcium intake begun some twenty months ago are now reported. A low but not calcium-free diet was achieved by giving a synthetic milk Soylac (with soya bean flour as its main ingredient) in place of cow's milk powder. Soylac was chosen for simplicity of preparation in order that the diet could be continued easily after discharge from hospital. Given as a solution of

1 oz. Soylac in 7 oz. of water, it provided 17 cals. per oz. and 9 mEq. of calcium per litre. Human milk contains about 17 and cow's milk 61 mEq./l. (Shohl, 1939). Sugar was added to raise the calorie value to 20 per oz.

Case Histories

Case I.—Boy, J. W. (patient of Dr. N. M. Jacoby). Born 12.3.51. Birth weight 5½ lb. Full term. Normal delivery. No significant family history.

Postnatal history.—Inspiratory stridor from birth. Pneumonia on 5th day; bottle-fed thereafter.

History of present illness.—Steady weight gain until 4th month. Vomiting, at first only occasional, then intensified, whilst anorexia and constipation became troublesome. Increasing restlessness; frequent unaccountable screaming.

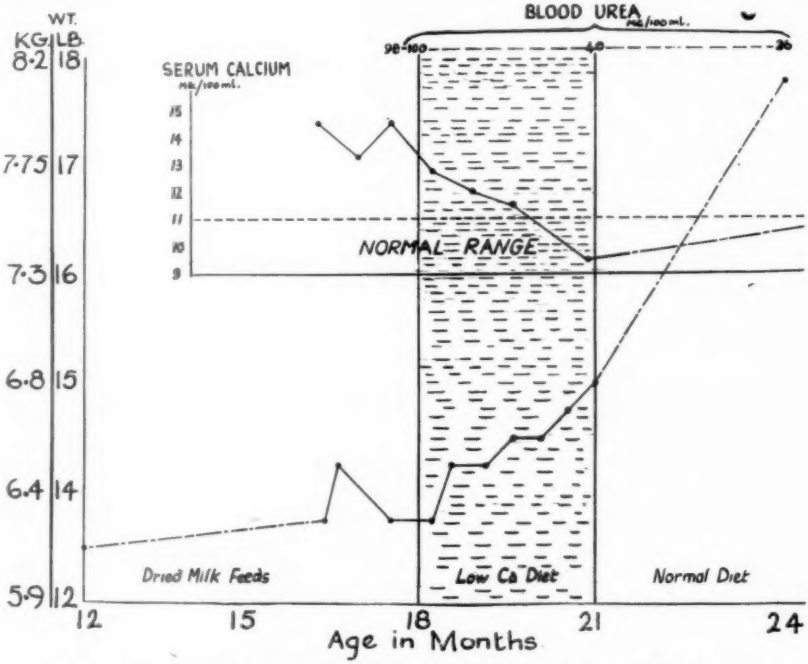

FIG. 1.—Hypercalcæmia with gross mental and physical retardation. J. W.'s response to a low calcium diet.

Aged 6 months (September 1951): Admitted to Queen Elizabeth Hospital for Children. Weight 12 lb. 2 oz. Depressed bridge of nose and persistent epicanthic folds. Stridor persisted. Exceedingly difficult to feed, taking only 2–3 oz. of milk per feed. Never smiled; unable to lift head. Bone age 0–3 months. Incessant crying controllable only by heavy sedation. Continuous waving of arms and legs with frequent jerky movements. Behaviour attributed to amentia. Head circumference 16 in. C.S.F. and air encephalogram normal.

X-ray skull: increased density of cranial base extending to frontal region.

Other findings: C.V.S.: Systolic bruit maximal 2nd and 3rd left interspace: no thrill. Blood: Leucopenia developed during admission, persisting for eleven months. No definable connexion with basic disorder.

Aged 17 months (August 1952): Readmission to hospital. Emaciated (no weight gain for preceding nine months). Anorexia and constipation persisted. All solid food still rejected. Length 27 in. Bone age 3–6 months. Head: relative microcephaly. Circumference 17¼ in. (ant. font. closed). General "hypotonia", but deep reflexes exaggerated. Held head up, but no smile. Continuous aimless limb waving with occasional myoclonic jerking. Mouth: high arched palate. Teeth: 14.

B.P. 95/50. Systolic bruit no longer audible.

X-ray skull: amorphous density of cranial base apparently unaltered. Vertebræ: dense transverse bands just within proximal and distal margins. Translucent centre of body outlined by dense ring. Long bones and pelvis: broad metaphyseal stratification of increased density. Epiphyses, carpals and tarsi: concentric rings of increased density in femoral and tibial epiphyses, with density maximal at centre.

Subsequent laboratory findings.—Serum calcium 14·5 mg./100 ml. on two occasions. Blood urea 108 mg./100 ml. Urine: pH 5·2. Albumin: trace. No casts or cells. Sulkowitch subnormal (two occasions). Daily output: Volume 555 c.c. Calcium 25·3 mg./100 ml.; total 115 mg. Phosphorus 63 mg./100 ml.; total 286 mg. Max. S.G. (thirsting) 1010. Urea clearance low.

August 1952 (*aged* 17 *months*): *Response to low calcium diet* (*Fig.* 1).—A low calcium diet was instituted. Except for brief interruption (for twelve days after seven weeks) this was sustained over a fourteen-week period. Adequate caloric intake achieved by substituting Soylac for dried milk powder. The prescribed daily intake of 5 oz. of the Soylac contained about 182 mg. calcium (cf. approx. 1,220 mg. calcium in the milk of normal diet). One egg (=37 mg.Ca) + ½ oz. butter was also provided daily. Initially, the actual calcium intake rarely exceeded 140 mg. or 7 mEq. of calcium daily since he took only an average of 2¼ oz. Soylac daily (i.e. approx. 80 mg. calcium or 4 mEq.) until his appetite improved.

Over this fourteen-week period, the serum calcium fell from 14·5 to 9·5 mg./100 ml., remaining within the normal range subsequently. Blood urea declined from 108 to 40 mg./100 ml. during this period to remain normal thereafter. Appreciable clinical improvement gauged by greater alertness, reduced irritability and crying, and improved appetite. Weight rose by 12 oz. in the first six weeks, significant in light of complete weight arrest during preceding nine months. Skeletal maturation showed progress (three to six months over three months).

We are indebted to Dr. B. E. Schlesinger for progress and laboratory data from January 1953 when he was admitted to the Hospital for Sick Children, Great Ormond Street.

Aged 22 months: Wt. 15 lb. Head circumference 17½ in. E.E.G. normal. Urine (incl. chromatography) normal. Serum calcium 9·5 mg./100 ml. Blood urea 40 mg./100 ml. Normal diet resumed. Improvement in appetite and steady weight gain maintained. Could sit unsupported, but preferred to lie on back vigorously banging limbs on floor.

Aged 2 years 5 months.—Wt. 17¾ lb. Ht. 30 in. No further feeding difficulty. Able to stand. Head circumference 18 in. Bone age: progress accelerated, with twelve to fifteen months' advance in eight months.

Aged 3 years: Wt. 20 lb. 6 oz. Still very retarded but steady general progress continuing.

Case II.—Boy, T. W. (patient of Dr. R. H. Dobbs). Born 20.11.51. Birth weight 6 lb. 11 oz. Induced surgically at term for pre-eclamptic toxæmia. 2-para.

History.—Anorexia and constipation from birth, intensified at 4 months. Partial breast-feeding for first two months; frequent changes of dried milk thereafter because of anorexia. Vomiting began during 5th month. Weight gain slow over first four months, then ceased.

Aged 7 months (June 1952): Admitted to Southend General Hospital under Dr. R. H. Dobbs. Wt. 11 lb. 7 oz. Pale lean infant with generalized hypotonia. Lifted head and smiled but unable to sit unsupported. Depression of nasal bridge; chin hypoplastic (Fig. 2A). C.V.S. normal. B.P. 90/65.

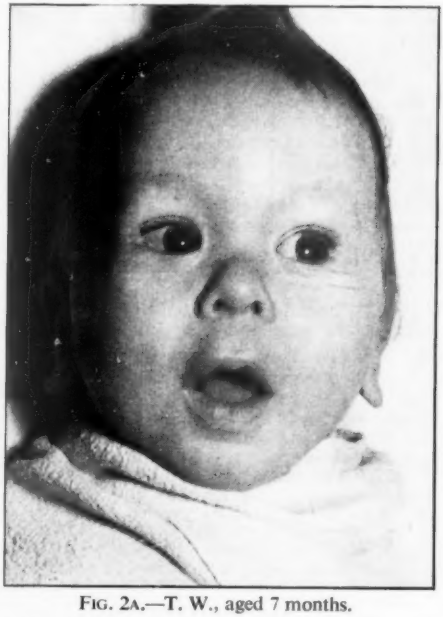

FIG. 2A.—T. W., aged 7 months.

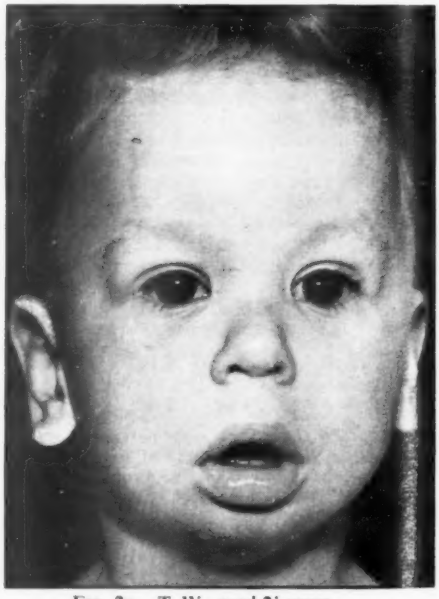

FIG. 2B.—T. W., aged 2½ years.

Abnormal laboratory findings.—Serum calcium: 12 mg./100 ml. Blood urea: 120, 90 and 140 mg./100 ml. Hæmoglobin 58%. Urine: pH 5·1; max. S.G. (thirsting) 1015; albumin: trace; few leucocytes + occasional casts.

Aged 9 months (August 1952): Transferred to Queen Elizabeth Hospital for Children. Wt. 13 lb. Exaggerated deep reflexes despite general hypotonia, as in Case I. Serum calcium levels then 14·0 and 14·6 mg./100 ml. Blood urea 106 mg./100 ml. Slight albuminuria, with cells and casts in urine. Radiographs of bones: Similar changes to those in Case I involving cranial base, vertebræ, pelvis and long bones. But bone-age showed no retardation. Response to low calcium diet: The low calcium diet based upon Soylac as in

Case I given for only four weeks because of parental prejudice against it, but the serum calcium fell from 14 to 10·5 mg./100 ml. and two months later there had been no rise above 11·1 mg./100 ml. No concurrent fall in blood urea. Apart from slight improvement in appetite and weight gain, no convincing changes in clinical condition. Serial radiological studies thereafter revealed a return to normal bony structure in the long bones, and a reduction of density at the cranial base.

Subsequent progress (in part recorded after admission to Hospital for Sick Children, Great Ormond Street, under Dr. Philip Evans to whom we are indebted for data).—Aged 1 year 8 months: Wt. 17 lb. 8 oz. Some difficulty in feeding and still retarded mentally and physically. Serum calcium 12·8 mg./100 ml. Blood urea 91 mg./100 ml. Aged 2½ years: Wt. 19 lb. 12 oz.; facies unchanged (Fig. 2B).) Sat unsupported, but unable to stand. Solid food still refused. The high blood urea persisted although the serum calcium level was normal at 10·2 mg./100 ml. Bone-age normal.

Discussion

Response to low calcium intake.—Serum calcium levels became normal in both cases after several weeks of low calcium dietary. In Case I, treated for fourteen weeks, blood urea levels also fell to normal, neither hypercalcæmia nor azotæmia recurring thereafter, and clinical improvement was maintained. In Case II, although the fall in serum calcium was more rapidly achieved during a shorter (four-week) period of low calcium intake, the blood urea was unaffected. A normal serum calcium was sustained for at least two months after resuming a normal diet, but a high level of 12·8 mg./100 ml. was again recorded seven months later. The instability of serum calcium, persistence of azotæmia, and dubious clinical improvement suggest only a transitory response. This may be attributed to the shorter duration of calcium restriction than in Case I, although more profound renal dysfunction may also have been a factor.

Spontaneous remission of the hypercalcæmia characterizes the mild form of this syndrome, and may occur belatedly even in the severe type. But it seems improbable that the apparent response observed in our 2 cases to relatively short periods of low calcium intake merely represented coincidence with such spontaneous remission.

The initial fall in serum calcium is probably a direct result of the reduced calcium intake: abnormal metabolic mechanisms possibly enhancing calcium absorption, or limiting its tissue utilization, or impeding its renal clearance, would thus be deprived of their calcium load. The sustained stabilization of the serum calcium at normal levels long after resuming a normal calcium intake in Case I is of greater significance, and suggests more profound readjustments. It is possible that the calcium deprivation, if sufficiently prolonged, breaks a cycle of disordered function which is both maintained by and at the same time perpetuates the hypercalcæmia long after the initial pathology had ceased to be active. One link in the cycle might be renal dysfunction. That calcium depletion might have operated primarily by improving renal function is suggested by the fall in blood urea in Case I. A return to normal tissue calcium concentrations might operate primarily either locally, by improving renal function, or centrally, by restoring normal cerebral or neuro-humoral control of renal function, and also more general functions of growth and neuromuscular development.

The apparently favourable effects of a low calcium diet have significant ætiological implications. Stabilization of the serum calcium at normal levels long after resuming an ordinary calcium intake rules out active *primary hyperparathyroidism.* "Osteosclerosis", of the type characterizing severe cases of idiopathic hypercalcæmia, and the absence of hypercalciuria also oppose it.

On the other hand, in *hypervitaminosis D* the sequence of relief effected by withdrawing vitamin D and restricting calcium intake closely parallels the progress in our cases in response to a low calcium diet. Within two or three weeks, both blood urea and calcium levels fall towards normal together with prompt improvement in anorexia, vomiting and constipation, but neuromuscular and cerebral impairment may last much longer, and even permanently (Debré, 1948). The absence of a history of recent high intake of vitamin D does not exclude the possibility of transient excess having operated many months previously. Hypercalcæmia may be perpetuated long after such an incident of hypervitaminosis, having been traced even twenty months later (Howard and Meyer, 1948). *Maternal overdosage with vitamin D*, especially during the last trimester of pregnancy might therefore be a responsible factor. The fœtus would at once suffer some primary intoxication, but accompanying hepatic storage could be a more serious threat, with postnatal vitamin-D intoxication following its gradual subsequent release. Symptomatology might only become conspicuous as the calcium intake increases with the introduction of cow's milk, fortified cereals, &c. Chronologically such a process could have been operative in our two cases, three months of apparently normal progress having preceded the onset in each. Although it is unlikely that hypersensitivity to a relatively small intake of vitamin D (Jeans, 1950) could be a causative factor in such cases, it may play a role in milder examples.

There is no evidence from their history that our cases could represent the infantile counterpart of the adult syndrome of hypercalcæmia without hypercalciuria which depends upon protracted excess of milk and alkali (Burnett *et al.*, 1949), although an appropriate set of circumstances might arise to produce it in infancy during prolonged alkali therapy for urinary and gastro-intestinal disorders.

It may be concluded that the pathological process underlying the severe and chronic form of hypercalcæmia in infancy is intoxication with vitamin D or with some factor resembling this in its effects, probably initiated prenatally. The milder forms may have a more varied ætiology, but those

with considerable clinical disturbances for which no other cause is apparent, are likely to be due to the same causative factor operating later or with less intensity than in the cases with manifest skeletal changes and gross mental and physical retardation.

The sustained response to a low calcium diet of such a severe form of the disorder as is exemplified by our Case I affords promise that this method of treatment will effect a more rapid and complete response in the milder forms of the disease. The infants may thus be saved a protracted episode of poor nutrition and perhaps in some cases irreversible renal damage.

In trials of a low calcium diet for milder transient forms, however, consideration must first be given to other factors potentially leading to hypercalcæmia such as immobilization, during which bone resorption is increased, as well as to associated conditions, such as renal acidosis, demanding their own specific treatment.

ACKNOWLEDGMENT

We gladly acknowledge our indebtedness to Dr. B. Levin and members of his staff for the biochemical findings upon which this report is based.

ADDENDUM

Since these cases were shown, a report has been published by Ferguson and McGowan (1954) describing an apparently good clinical response to low calcium diets in four examples of the *mild* form of idiopathic hypercalcæmia. In each case the serum calcium had fallen to normal in two to six weeks. The milk had been prepared (1) by an elaborate dialysing procedure using a cation-exchange resin and (2) by using a low-calcium casein as a basis for artificial milk. The calcium concentrations were 1 to 5 and 2 mEq./l. respectively.

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A Syndrome of "Intra-uterine" Dwarfism Recognizable at Birth with Cranio-facial Dysostosis, Disproportionately Short Arms, and Other Anomalies (5 examples).—ALEX. RUSSELL, O.B.E., M.D., M.R.C.P.

THE five children demonstrated illustrate a relatively specific syndrome of dwarfism which is already recognizable at birth. There is also important evidence pointing to an intra-uterine origin for their anomaly such as is apparently lacking from the histories of that heterogeneous accumulation of ill-defined dwarfs labelled as primordial. In 3 of the 5 cases, a threatened abortion marked the first trimester of pregnancy. In Case IV (A. B.), bleeding actually began between the 5th and 6th weeks, but was less precisely dated between the 7th and 10th weeks in Cases I (D. S.) and III (L. E.). In each of these 3 cases and in one without such a history of early antenatal hæmorrhage, a record was traceable of a "very small" infarcted placenta. There is thus some corroboration for the implication of placental pathology or the impact of some maternal or embryonal disorder during a crucial embryogenetic phase.

Because of birth weights ranging between 3 and 4 lb., each infant had been treated as premature despite indignant denials by their respective mothers. Yet the period of gestation was clearly full-term, in 2 cases actually post-mature by about two weeks, so that the low birth weight merely reflected a state of growth-failure already established prenatally.

Attention is thus drawn to confusion with prematurity of this and analogous groups of dwarfs, inevitable under present-day conventions defining prematurity as existing whenever the birth weight is below 5½ lb. (2,500 grams). But in addition to their conforming at birth with the weight of a 30- to 34-week fœtus, their length, 14·0 in. (35·5 cm.) and 14·5 in. (36·8 cm.) in the two examples where this is known, corresponds with that of only 28 to 30 weeks of fœtal life. Hence linear indices, crown-rump or crown-heel (e.g. less than 47 cm. according to Peckham, 1938), would still further mislead if the period of gestation is ignored. Inclusion of such infants in surveys of prematurity could weigh the evidence in favour of a predisposition to growth retardation.

A birth weight of 3 to 4 lb. is thus the first neonatal criterion of intra-uterine dwarfism provided that the full-term or post-mature gestational history and absence of immature features excludes prematurity. Suspicion may be aroused even earlier since in one exceptional record (Case V, L. W.) smallness of the

uterus was a source of perplexity beyond the 3rd month, the fundus of the uterus scarcely extending above the umbilicus at full term. In the newborn, recognition of the following specific association of anomalies completes the differentiation:

(1) *Cranio-facial pattern.*—Its general outline is roughly triangular, the base being made up by the broad biparietal diameter of skull and high bossed forehead, tapering down to a hypoplastic receding chin at its apex. The smallness of the face relative to the skull often conveys an impression of hydrocephalus in infancy, although the head circumference has only exceeded that appropriate to the length in two examples, and then by only 0·6 in. and 0·7 in. Anterior fontanelle closure is delayed usually into the third year. Hair texture and distribution remain normal.

FIG. 1.—D. S. Snapshot at age of 4 months already clearly illustrating short arms and typical cranio-facial pattern (high bossed forehead, broad biparietal diameter, well-developed nasal bridge even in infancy, down-drawn angles of mouth with outer segments of upper lip overlapping those of lower lip, and hypoplastic chin).

Nose: Prominent, with just perceptible beaking of its tip, and a bridge which is well developed even in early infancy, occasionally merging above into a heaped-up metopic suture (Fig. 2).

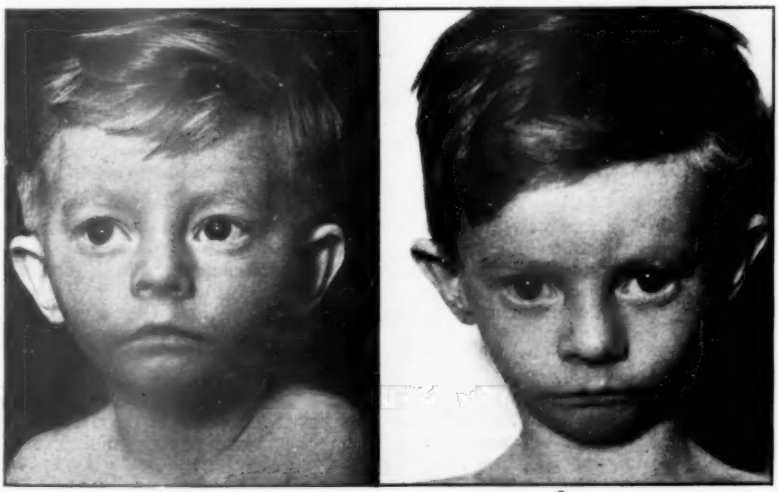
Mouth: The philtrum is sharply updrawn, but outer angles downdrawn to make up an inverted "V" or "shark-mouth", recalling the embryonic mouth cleft. Outer segments of upper lip overlap those of the lower lip, occasionally extending into short folds bilaterally, possibly the result of incomplete fusion of the primitive mouth cleft (which may also account for a relative macrostomia). A snapshot of Case I at 4 months (Fig. 1) clearly reflects these features, as well as the short arms, *see* para. (2).

(2) *Skeletal proportions, &c.*—Disproportionate shortening of the upper limbs is characteristic; the span usually remaining 1·6 to 2·6 in. less than that appropriate to the stunted height. In contrast the lower extremities are relatively long in relation to the height (Table I).

Elbow: The carrying angle may be absent or there is actually cubitus varus (as in Case I), with supination incomplete.

Hands: Incurved "mongoloid" little finger.

Thorax: Narrow tubular chest. Infantile ratio of head to chest circumferences persisting into later childhood.



2A. 2B.

FIG. 2.—A, D. S. Typical cranio-facial pattern at age of 3½ years, and B, unaltered at age of 7 years.

Spine: Slight lordosis is mainly responsible for protuberance of the abdomen.

(3) *General configuration.*—Lean but not emaciated, the weight deficit being greater than that of the height. The muscles remain small, presumably sharing with skeletal and subcutaneous tissues in a more generalized hypoplastic process.

(4) *Other congenital anomalies.*—In 2 of the 5 cases, a slight degree of hemiatrophy (Cases III and V), in 2 calcaneo-valgus deformity (Cases I and IV), and in 1 ptosis (Rt.) (Case V) were superimposed.

Associated Clinical Pattern

Anorexia aroused anxiety from the outset, life often appearing precariously balanced during early infancy. So far the 5 children here described have survived, however, and they are alert, friendly, lean but wiry and often hyperactive. Intellectual development is normal. They have peculiarly high-pitched "squeaky" infantile voices, persisting until the 8th year in Case I. Their spindly limbs and general "fragility" have become increasingly conspicuous as they reached their 4th and 5th years.

Salient details at representative age phases are tabulated (Table I). Photographs of 2 are also reproduced here (Figs. 1 to 4), but fuller individual studies will appear in a subsequent publication.

Fig. 3.—D. S. General configuration at age of 3½ years.

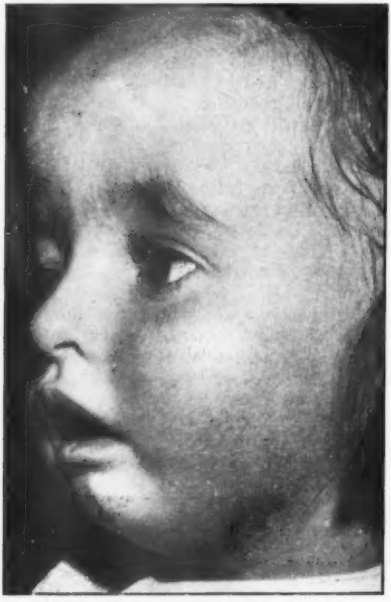


Fig. 4.—L. W. Characteristic cranio-facial features at age of 18 months (Courtesy of Dr. W. Sheldon).

The series includes examples from the age of 18 months (L. W., a patient of Dr. W. Sheldon, Fig. 4) to our first case (D. S., a patient of Dr. R. H. Dobbs, Figs. 1–3) now 8 years old, whom we have followed closely for over four years. All have pursued remarkably parallel courses in respect of growth and weight gain, with lengths remaining approx. 3–4 in. (8–10 cm.), and weights 6 lb., below respective 3rd percentile levels. Relative proportions and skeletal maturation have also shown consistent retardation. Thus it has been possible to predict precisely the dimensions of cases presenting within the age-range studied by reference to the growth pattern of previous cases.

Investigations

No underlying systemic or metabolic disorder has been defined in this series. Twelve-day nitrogen and fat balance studies were normal in the 2 cases so studied. Amino-acid output was normal. Although serum cholesterol levels ranged around the upper limits of the normal range, both the clinical findings and radioactive iodine studies strongly opposed hypothyroidism. Apart from impaired "hypoglycæmic responsiveness" after intravenous insulin, the same 2 examples revealed no evidence of panhypopituitarism. Intracranial air-studies also proved negative in these 2 cases. In the light of such negative findings, clinical recognition of this syndrome should save the child much fruitless investigation.

TABLE I.—TABULATION OF SALIENT FEATURES IN THIS SERIES WITH RELATIVE DIMENSIONS AT REPRESENTATIVE AGE PERIODS

Case numbers	I	II	III	IV	V
Salient Features	D. S. ♂	D. R. ♂	L. E. ♀	A. B. ♂	L. W. ♀
Birth weight	4 lb.	4 lb.	3 lb.	3 lb.	3 lb.
Period of gestation	Post-mature 16 days	F.T.	Post-mature 12 days	F.T.	F.T.
Threatened abortion	+ 9 weeks	—	+ 7th week	+ 5th–6th weeks	—
Placenta	V. small	—	Small and infarcts	V. small and many infarcts	V. small and many infarcts
Basic malformations	+	+	+	+	+
Other anomalies	Calcaneo-valgus deformity bilat. Absent cardiac sphincter	Delayed ant. font. closure	Hemiatrophy	Cryptorchid Delayed ant. font. closure	Hemiatrophy Rt. ptosis
Age	7 yrs.	4 yrs. 1 mth.	3½ yrs.	2½ yrs.	1½ yrs.
Relative Dimensions:					
Height deficit below 3rd perc.	2·5″	4·5″	2·75″	8·75″	3·5″
Weight deficit below av. height std.	9 lb.	5·5 lb.	5·6 lb.	5·8 lb.	2 lb.
Span deficit below av. height std.	2·0″	1·7″	1·6″	2·65″	2·0″
Lower segm. Excess above av. height std.	2·9″	1·6″	1·3″	1·7″	2·0″
Head circ. related to av. height std.	−0·8″	+0·6″	+0·6″	−0·9″	+0·7″
Chest circ. related to av. height std.	−3·0″	−2·7″	−2·5″	−2·4″	−3·2″
Intellect development	N	N	N	N	N

COMMENT

The growth anomaly.—The low birth weight at full-term can be interpreted as the outcome not only of severe prenatal growth-failure of the skeleton but also of muscle and subcutaneous tissues. This may be conceived as a combined hypoplasia of all 3 components of the embryonic somites deriving from paraxial mesoderm, viz. (1) the sclerotome which is to develop into axial skeleton, (2) the myotome into skeletal muscle, and (3) the dermatome into integumentary tissues, including subcutaneous. The hemiatrophy in Cases III (L. E.) and V (L. W.) is of great interest in suggesting an associated disturbance of a central mechanism governing the symmetry of growth.

Previous comments upon relationships between a low birth weight and dwarfism have dwelt upon its role in *predisposing* to "later stunting of growth" (Horstman, 1949) and this was attributed primarily to maternal nutritional factors. In infants with birth weights as low as in these cases, despite a normal length of gestation, the birth weight should now be accepted as an index of established dwarfism.

Environmental intra-uterine origin of this syndrome.—Definition of the pregnancy rubella syndrome (Gregg, 1941), which occasionally included stunting of growth, drew attention to the ætiological importance of environmental factors in human congenital anomalies. The relative contributions of genetic and environmental influences, however, can seldom be justly apportioned, particularly since the very nature of the response to environmental factors may be predetermined by the genetic matrix. Nevertheless a strong case for acquired intra-uterine growth-failure in our particular infants can be based upon the history of threatened abortions and placental pathology. Our complete failure to define any hereditary growth or other abnormal trait in the family pedigrees concerned supports this.

Detailed discussion of the possible nature and timing of the teratogenic factors involved in the production of this syndrome must be left for subsequent publication. The critical time for most of the anomalies is likely to lie within two particular intra-uterine weeks, the 6th and 7th, mainly the latter. Vital stages in the differential of limb bones, of relative upper limb dimensions, of the elbow and mandible, as well as the elimination of the grooves separating facial components including the angles of the mouth cleft (Hamilton *et al.*, 1945) all appear to coincide at this point.

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I am particularly grateful to Dr. R. H. Dobbs who encouraged my study of his patient D. S., subsequently to become the prototype of this growing family. I am deeply indebted also to Drs. Wilfrid Sheldon, Ursula Shelley and Ursula James who so kindly referred these cases to me and generously permitted me to cite them here, and to Dr. B. Levin, Director of the Pathological laboratories at the Queen Elizabeth Hospital for Children, for unstinted help with metabolic investigation.

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DISCUSSION ON ADOPTION

The Hon. Mrs. Geoffrey Edwards:

There has never been any really comprehensive scientific study of adoption, and until such a study has been made we have only our own impressions to go on, as to whether it is usually the best way of dealing with the illegitimate child. Obviously we have to try to assess the pros and cons in each individual case; and in order to find out all the relevant facts a great deal of time is needed. The first rule for a good adoption, therefore, is that it should not be arranged in a hurry. Not only does the person who arranges an adoption need time to find out about both the prospective adopters and the child; but, even more important, the mother of the baby needs time to make up her mind what she wants to do. Unfortunately, at any given moment there are hundreds of girls in hospital with illegitimate babies, due to be discharged in a few days' time, who have no idea what they are going to do when they leave hospital. Their parents or their landladies will not have them back with a baby, and they cannot find lodgings, or a job, or a place in a nursery for the child; and in those circumstances they are in a frame of mind in which they will give the baby to anyone who will take it. These panic adoptions are unlikely to be 100% satisfactory, and may be very unsatisfactory indeed; and if they are to be prevented we must ensure that an unmarried mother has some time in a neutral atmosphere after the birth of the child, so as to be able to come to a decision calmly. About 90% of unmarried mothers have at some stage of their pregnancy wanted the child to be adopted at birth; then, either shortly before or shortly after the birth, a very large proportion of them decide that they cannot possibly part with the child. We must try to prevent the mother's feelings becoming crystallized at one or other of these extremes, and allow her to come to an equilibrium before deciding.

I do urge anyone who comes across an unmarried pregnant girl to put her as soon as possible in touch with someone whose business it is to look after such problems. The National Council for the Unmarried Mother and her Child claim that if they know of a case early enough—i.e. before the child is born—they can always make a plan, in consultation with the girl, which will give her just that breathing space she needs. They give their whole time to this work, deal with each case in strict confidence, and tackle the difficulties involved as someone with other claims upon his time cannot do.

It is sometimes said that it is cruel to allow a mother to have the child with her for several weeks or months, and grow fond of it, when she knows she will have to part from it eventually. Even if this were so, it is surely arguable that if, for example, it is a good thing for a baby to have even a short experience of its own mother's love and its own mother's milk, she might be asked to make the sacrifice for her child. But in point of fact, it is not at all certain that to part mother and child immediately after birth is ever the kindest thing for the mother. I know of cases in which the mother has parted with her baby a fortnight old to most admirable adopters; and after some weeks or months she has had quite a serious breakdown, because she has felt that she sacrificed her baby for her own or her parents' or her employers' convenience. On the other hand, the girl who loves and cares for her baby for some time and then parts with it, does so in absolute agony; but in a curious way she makes up for the pain by the thought that she is sacrificing herself for the good of the child, and not the other way round. She has been able to come to terms with the situation and work it out as seems best to her for the baby's sake.

There was a time when adoption was the last resort of any serious social worker. Every other solution had to be tried first. Now the pendulum has swung to the other extreme; and it seems to me that children are sometimes placed for adoption too light-heartedly, without sufficient thought as to whether they will make the grade. The worst fate that can befall a child is to feel that its parents do not approve of it. If the child is born to them, they know that they have to put up with what has been sent to them; it is just hard luck. But adoption, like marriage, is a question of choice, and as in marriage, so in adoption—if you choose badly you do not blame yourself, but the one you have chosen. Many adopted children suffer from the instinctive knowledge that their parents are disappointed in them. It is a consciousness of this fact that makes some people say that a child must never be adopted to fulfil a need of the adoptive parents, but purely for his own sake. I think that is nonsense. There are people who come across a deprived child, and are so conscious of his needs that they decide to adopt him; and that is a good sort of adoption, because such people demand nothing of the child: all they want is to give. But there are hundreds of adoptions where the only motive

is the adopters' need for a child; and the fact that the child is deprived is, from their point of view, an opportunity of satisfying their own needs. This need not be a bad thing, provided the need is one the child is capable of satisfying; in other words, provided they just want a child. But many adopters want a perfect child—female, of course—beautiful, clever, a social success, who will pass examinations with ease and marry young into the aristocracy; and the ordinary snub-nosed little girl with whose lovely blue eyes they fell in love at six weeks old cannot live up to this ideal. Then the child is unjustly blamed for letting them down.

An unhappily married couple think for some reason that a child will pull them together; and when the introduction of a third person into the household intensifies all the strains that are there already, they blame the child. Or the mother of a spoilt only child thinks it would be good for him to have a companion, and imports a boy of about the same age to be his little brother. Her own child resents the intrusion of this interloper, and becomes more intolerable than before; and the parents, instead of blaming themselves for their idiotic decision, blame the poor little boy they have brought into their home by no wish of his own, and often turn him out again, so that his last state is worse than his first.

It used to be a very common thing for hospital staffs and midwives to arrange the adoption of newly born unwanted children by mothers who had lost their own baby at birth. This does often help the unfortunate bereaved mother for the time being, by filling her empty arms; but at such a time she is not in a fit state to make a decision which will affect her and her husband for the rest of their lives. She needs a time of mourning in which to come to terms with her grief, and should not have to make any further emotional adjustments. It is not fair either to her or to the child, who, when he is older, is apt to find himself in competition with the ideal child that died. "If my own little darling had lived, he would have behaved differently"—the adopted child is an inadequate substitute, and knows it.

It goes without saying that a child should never be handed over as a treatment for neurosis! But these "therapeutic adoptions" do sometimes take place.

I have spoken about arranging adoptions, but the vast majority of adoptions in this country are not arranged by anyone. In 1952 there were 15,000. 2,500 were arranged by adoption societies, and possibly another 500 by Local Authorities. Most of the rest were quite casually settled, either by the mother herself handing the child to a friend or relative, or by a third party acting as intermediary. Some of these private arrangements are, of course, concluded by people who understood the difficulties involved; but many are made by people who look no further than the day after tomorrow. Whereas the adoption society or the Local Authority is obliged to consider all sorts of facts about the history and family circumstances on both sides, this need not be so in private adoptions. The only duty laid upon a private "third party" is that he should notify the Local Authority at the receiving end seven days before the child is placed. Even if the "third party" knows of this requirement, seven days is not long enough to allow the case to be investigated; and if the Local Authority disapproves of the adoptive home, it has no power of veto.

These facts have led many people to demand that private adoptions should either be prohibited, or so stringently regulated that abuses cannot arise. But though we do not want to make adoption too easy, still it should not be made so difficult that people prefer to keep the child in their families without adopting him. Even as things are, there are many children living in families, called by the family name, knowing no other parents, and unaware of their origins, who have never been legally adopted. The child is not his foster-parents' legal next-of-kin; he inherits nothing if they die intestate, and he has lost one family without acquiring another in the eyes of the law. Sometimes such a child does not know until after his foster-parents' death that he is not their own child; and by that time it is impossible for him to find out his real name or obtain any kind of birth certificate. It is possible that the dramatic drop in legal adoptions from 19,000 in 1949 to 13,000 in 1950 may have been partly due to the fact that from January 1, 1950, everyone who applied to adopt a child had to be under the supervision of the Local Authority for three months. It may be that some people objected so strongly to what they called "snoopers" that they decided to continue an informal arrangement and not proceed to legal adoption at all. If that is so, it may be an argument against further regulation.

Be that as it may, each one of us has a personal responsibility to ensure as far as possible that we do nothing to facilitate the placing of children in unhappy homes. The ideal adopters are the couple who take the child as they have taken each other, for better for worse, for richer for poorer, in sickness and in health; and who will devote themselves heart and soul to the child's well-being just as they would have done had he been born to them. Anything we can do to ensure that all adoptions are of that type will result in happier families, and so a happier and more secure society.

Dr. A. White Franklin:

A discussion of adoption could range over subjects as diverse as sex education in schools, trial marriage, legalized abortion, the management of infertility, artificial insemination, the ascertainment of infant mental defectives and much more besides.

Adoption is a technical method which helps to solve such serious problems as illegitimacy, childlessness absolute or relative, and the nurture of the unwanted or the unattached child. It is also a

human enterprise, where sin or wickedness or foolishness are met by pity and love, where biology jostles passion, and the intruder—reason—has little place and less power. In the event a child awaits the decision of his mother and of the adopting parents. For those charged with the responsibility for advising the unmarried mother, many questions need answers. How is the woman to decide whether to keep or to give up her baby? And when? How is her own future affected by her decision? What is the effect of her decision on the personality, the character and the stability of her child? What qualities and what intentions make good adopting parents? Who is competent to advise the mother? Is there any general guide for answering these questions? Does the solution in fact matter or is this only one of life's experiences, bitter and chastening for mother and baby, but, through the wonderful healing power of adjustment, giving to the human spirit the strength by which it grows?

My own thoughts about adoption have illegitimacy as their background, and to attempt some answers, groping and indefinite as most must be, I will review the story of four hundred and sixty girls from the wartime Services, whose illegitimate babies survived birth and the first month of life. During the late war I acted as pædiatrician to an ante- and post-natal hostel with whose remarkable Matron these questions have been discussed and to whom belongs the credit for the large labour which this study demanded. Although her observations and her careful and friendly follow-up during the eight years since the home closed form the material, she must not be saddled with responsibility for the thoughts and the conclusions here presented.

The 460 mothers include 15 who were married and 1 who was a widow when the illegitimate pregnancy began; 444 were single and 17 of these had had illegitimate pregnancies before (Table I). The

TABLE I.—MOTHER'S AGE AT DELIVERY

Age	Q. Charlotte's Hosp. 1953 Hostel	Unmarried mothers
Under 15 years	0	2
„ 20 years	26	41
„ 30 years	386	80
„ 40 years	46	27
40 years and over	2	7

Hostel cases: 17 out of 444 single girls (1 in 26) had had a previous pregnancy.

peak ages at the time of the birth were the five years from 20 to 24; the mentality was average in 290, bright in 124 and dull in 46, Service selection having presumably excluded the mental defectives. Emotional instability and a difficult personality were noted in only 63 girls. The family background was normal by ordinary standards in 383, unknown in 8, and abnormal in 69. These data are based on superficial study: no attempt was made to establish intelligence quotients, or, for example, to detect all who were conceived or born out of wedlock and brought up as legitimate. The figures are recorded and the group is assumed to represent a cross section of a normal population.

The man in the case is missing from these records, as, so often, he is in life. The events leading to the pregnancy are as difficult to establish as they are sometimes to believe. Undoubtedly in many, unaccustomed freedom and a love affair led to experiment or to what was planned as premarital intercourse. (Is this the part of the iceberg that shows above the waterline?) Promiscuity or an impulse to adventure accounted for a few. At times one girl after another gave the same story of rape in a railway carriage or of mixed drinks on a lonely gun-site. Married men having serious affairs outnumbered the rakes and the rogues. This seems true in peacetime also, to judge by a small series studied recently with Miss Noble at Queen Charlotte's Hospital, where most cases of illegitimacy followed intercourse with marriage in view or with a man already married.

At first the policy in the home was to encourage keeping the baby. In the atmosphere of the war, the girls were regarded and treated as casualties and cared for with every sympathy in the quiet of a large country estate. The burden of the obstetric problem was lifted from their shoulders, they were well fed and decently housed, and everyone was in the same boat. Families could be confided in or not, as established relationships directed. After Service life and the succeeding shocks that led through the fear and then the certainty of diagnosis, to bewilderment and panic, the hostel presented a haven of refuge where the girl could settle in privacy until it was all over. Many had one thought only—to get the child adopted and at the earliest possible time. But to some the baby to come already stood not for sin but for the happiness and the beauty of an experience gone beyond recall. To decide at this antenatal time is unwise and it is by no means always practical, if the baby for adoption is required to be physically normal. The expectant mother must be given time and must achieve the certainty that the decision, lifelong for her and her baby, is soundly based and wisely executed. No pregnant woman can know what will be her feelings after her first baby is born. As it takes six or eight weeks for the normal married woman to return to her usual emotional balance after her confinement, the unmarried mother is not likely to manage better. The pain of separation, bad enough if due to stillbirth or death, may if self-inflicted be unbearable and unending. An unalterable decision before the birth is bad policy and to snatch the newborn baby from its mother without her

seeing it is worse. A peacetime exception must be made for the girl in her early teens, especially after incest.

If it is bad to decide too soon, so also adoption may come too late. The importance of stability in the first two years of the child's life is very great, even if it is at times exaggerated. Many changes of handling or moves of home are always bad at this time. To bring a child up as an institution child with large—diluted—human relations, too little supplied by too many, and then to expect him at seven or eight or older to settle in a childless home where there is too much from too few, is to attempt the impossible and puts too big a burden on his shoulders. It is desperately important to come to the right decision as soon as it can be done, so that the baby deprived of its own mother can find and keep a substitute even in an institution. And it is important for the child that the decision once made should not be later changed.

This study suggests that for the girl from a normal family the deciding factors are her age, the maturity of her personality and whether her family rejects or accepts the situation. The young and immature girl needs her own mother as much as the baby needs her and all hangs on whether the grandmother is willing and able to take up the burden. If she is, the baby can be absorbed into the family and all is well. Sometimes the tribute of a fictitious widowhood has to be paid to gentility. Without her own mother's support the young girl is almost bound to arrange early adoption.

For the mature woman the responsibility is her own. She must face without a husband's help years of difficulty increasing at least until the child goes to school. She needs more than great love for her child. Without courage, competence and the ability to earn her living, she will fail so that late adoption has to be arranged. The quality of the mother must be the deciding factor, and selfishness revealed or concealed must be recognized and countered by anyone giving advice. The mother brought up in an institution or a foster home, possibly herself illegitimate or orphaned, may have an unstable or difficult personality. Starved of love and of self-esteem, she loses her balance the first time that a man takes an interest in her, and having had a baby longs with all her soul and with all her strength to keep this, her one intimate possession.

To attempt to follow the lives of unmarried mothers and illegitimate babies is inevitably difficult. Whatever the solution, the sleeping dogs must generally be allowed to lie. In the 450 cases (Table II)

TABLE II.—ILLEGITIMACY
460 Cases

Baby	Totals	Followed		Mother now married	Single
Adopted	179	82		41	41
Kept	281	216		70	146
Total	460	298		111	187
Demanded back during adoption			3	(Married baby's	
Kept but later adopted			27	father, 11)	
Kept but taken into care ..			3		

179 adoptions were arranged and the baby was kept in 281, in 3 the mother returning to her own husband and in 27 the baby having to be adopted later. In 3 cases the baby was taken into care. In 3 cases the baby was demanded back during the course of adoption. In 298 cases (including only 82 adoptions) a reasonable follow-up was carried out. To judge the success of the solution is difficult, but the girls deprived in their own childhood or having had a difficult home life, and those markedly difficult in personality have been specially studied, particularly in relation to the need to alter the plan originally carried out (Table III).

TABLE III.—FREQUENCY OF CHANGE OF PLAN AND MARRIAGE IN A SELECTED GROUP

	Baby kept	Adopted	Total	Plan changed	Married
"Deprived" upbringing	48	21	69	14 (1 in 5)	9 (1 in 7·5)
Emotional instability	37	25	62	11 (1 in 5·6)	11 (1 in 5·6)
Dull intelligence ..	31	15	46	6 (1 in 7·6)	10 (1 in 4·6)
Bright intelligence	67	57	124	11 (1 in 11)	39 (1 in 3·4)
21 years old and under	61	37	98	5 (1 in 20)	15 (1 in 6·5)
Whole group, including selected group	281 (61%)	179 (39%)	460	33 (1 in 13·9)	111 (1 in 4)

Out of 460 girls 69 came from institutions or foster homes and were themselves either illegitimate or orphans. Despite this deprivation 42 seemed well-adjusted personalities, but 27 were difficult. In 21 cases adoption was arranged, 16 mothers being notably distressed at an early separation. Of the 48 girls who kept their babies 11 had later to change to adoption and in three cases the local authority took the child into care, in two the mother ending in prison. In 14 the plan had to be changed, that is twice as often in these deprived girls as in the whole group (28 of 216).

The difficult girls numbered 62, 25 from institutions or foster homes, 20 from homes unsatisfactory

on economic grounds or by reason of excessively stern parents; in 3 no opinion was expressed about the home background, and only in 14 could the home be described as good. 28 of the difficult girls made a good adjustment, 8 becoming happily married. In 8 of these the baby was adopted. Of the 34 who made a bad adjustment, 17 kept their babies and 3 of these married. 11 were compelled ultimately to seek adoption or a foster home, and most of those whose babies were adopted early found the greatest difficulty in settling down. In this group of difficult girls as would be expected a change of plan was commoner than the average, though less common than in the "deprived" group.

There were 33 known changes of arrangement. 8 were girls from good homes, of whom 3 demanded the baby back in the course of adoption. 14 had been deprived children, 9 had very stern and unrelenting parents, 1 a widowed working mother, and 1 a stern father and a slut of a mother. What made the change necessary was deemed to be illness or death of the mother (2), failure of a marriage plan (1), stern parents (6), emotionally unstable girl (8, of whom 5 were in the deprived group), ultimate adoption by the girls' sister (4), inability to manage the baby as well as a job (9), in only one of which was the girl's home behind her). In some cases congenital defect or neonatal illness had put adoption out of the question and in others the illness of the baby affected the mother so deeply that she was thereafter unwilling to part with it. These changes and chances and their effects cannot be predicted.

Too much regard for figures misleads as much as too little in this most complex business of human relations. Nevertheless something may be learned from the analyses. While it is difficult for a girl to keep her child without any family behind her, it can be done and even if she is maladjusted, a good adjustment and even a happy marriage which includes the child can follow. The scales are definitely weighted against such a good result. The stern parent, unable to accept the problem and unwilling to help, forces adoption for any but the most strong-minded. The most difficult problem, as must be expected, is the maladjusted girl brought up in an institution. Such girls are the most likely to have further pregnancies and in this group by the same man. A report from a moral welfare worker on whether this unfortunate outcome is influenced by the adoption or the keeping of the first or second child would be valuable. As would also be a follow-up study of the lives of institution children in general. Some institution children did make a good adjustment, and some of the obviously "deprived" girls came from broken homes or had been fostered without love or understanding. A few of the girls, it is noted, were just bad girls.

Table II shows how many girls subsequently married, where the baby was kept and where it was adopted. In 11 the mother soon married the father, but even with these included the chance of marriage was better if the baby was adopted (50% against 32%). Probably the figures would rise in both groups in a longer follow-up. In some the experience finished the girl with men for ever; one assaulted by her fiancé could not forgive him. In one family twin sisters each with an illegitimate baby have with another unmarried sister set up a happy manless society. Yet many girls who kept their own babies found in the end a full and happy married life.

There is no perfect solution, only a "making the best of it". The pain of parting has marked some of these girls bitterly for life. How does this weigh in the balance against the hardness of the struggle when the baby is kept? This struggle cannot be comprehended beforehand, and although the baby might suffer, some mothers can only reach their decision by trial and failure.

It has not been possible to observe the long-term effect of the solution on the child. The practical problem of whether the baby should be breast fed in the Home had to be answered. The routine of breast feeding for six weeks became established. The great objection that it might make the mother love her baby more and therefore part from it less readily did not carry conviction. And anyway a newborn baby need such love. Tables IV and V show weight gains, morbidity and mortality in 157 and 203 consecutive cases respectively, and the justification of the policy is the better average weekly weight-gain, and, though the figures are small, lower morbidity and mortality rates.

TABLE IV.—FEEDING IN HOSTEL
157 *Consecutive Cases*

	No.	Av. weekly gain 0–6 weeks
Breast fed to discharge	26	6·13 oz.
Breast fed to 6 weeks	70	5·03 oz.
Part breast fed to discharge	38	4·05 oz.
Bottle fed (50 C./lb./day)	23	3·48 oz.
	157	4·7 oz.

TABLE V.—MORBIDITY AND MORTALITY
203 *Consecutive Cases*

Feed	No.	D. and V.	(Death)	Hospital for difficulty
Breast fed ..	121	0	(0)	0
Partly breast fed	51	3	(1)	1
Never breast fed	31	6	(2)	4 (1)

At the point where adoption is declared the solution, and this should nearly always be after the baby is born, a further series of problems arises, including whether and when and how the truth should be told to the child, the selection of suitable adopting parents both in general and for the particular child concerned, and what part the doctor plays.

If there is a problem over whether the baby should be kept, there is no less a problem over the selection of adopting parents, and the first question must always be why . . . what has happened to produce the decision to adopt? To help a mother overcome the immediate tragedy of a lost baby is like marriage on the rebound and just as dangerous. If the parents cannot face childlessness due to obstetrical tragedy or impotence or infertility and the marriage is foundering, adoption must be preceded by a full and frank discussion of the realities of the situation, hard though it may be to face these facts. To superimpose adoption on maladjustment in the family life is to court disaster. While the adopting parents must be seeking something for themselves, the danger of selfishness lurks in the situation. And if childless, they should undergo a full medical examination to see whether a child of their own is possible first. If it is impossible, the full report should not be presented to the parents without thought. The responsibility for childlessness is sometimes best shared if only for the sake of preserving stability for the adopted child.

For some doctors the only contact with adoption is in the failures—the maladjusted children—and the signing of certificates. It is right that prospective parents should know, if it can be known, about gross sensory defects like deafness or blindness (retrolental fibroplasia must be diagnosed early and makes adoption unwise because of the need for special residential schooling). Congenital heart disease or other diagnosable defect in bone or skin, congenital syphilis and a tendency to any later developing inherited disease should be the subject of a warning. More serious, because of the strain which they impose on the family are mental defect and neurological diseases like cerebral palsy. Such babies, of course, may need the security of life in a family more than normal ones, and some adopters realizing this will take an abnormal baby. Should a development quotient be estimated? Probably not as they are too unreliable. There might indeed be something to be said for letting adopting parents take babies by rota—as natural parents do. Whatever is on the certificate, only grosser physical conditions can be detected, and nothing can be told about those inner adjustments to growth, to awareness and to the emotional urges and drives of life on which the real future of the child depends. It is vital that the adopting parents do not expect too much of the child: they take him and they stand by him with faith for better or for worse.

I have left out the adviser and the agency. Adoption is like marriage, a biological problem and therefore the outlook on life of the adviser does affect her attitude and her advice. If sex is abhorrent or wicked, the girl must pay to the full the bitter price of sin. The childless spinster, taking a different stand from the happy mother of a family, may err by too much sentimentality and spoil and over-protect the girl. The childless wife may see in her work for adoption only her own personal problem multiplied again and again. These trends to biased views must be acknowledged and allowed for. There are many benefits of Adoption Societies and we must pay tribute to the pioneer work of Mrs. Plummer and her National Children Adoption Association which has led the way in the technical side of adoption. New Societies are springing up all over the country. As we have heard, this is a delicate and difficult business involving many in decisions of the deepest intimacy. People who would not care or dare to advise in the management of children, happily recommend and manage adoptions. The thought is not irrelevant that a marriage guidance counsellor might think two or three times before starting a matrimonial bureau.

[*June* 26, 1954]

MEETING AT THE BURSLEDON BRANCH OF SOUTHAMPTON CHILDREN'S HOSPITAL

Pædiatrics and Child Psychiatry—A Combined Approach

By MARY CAPES, M.B., D.P.M.

Psychiatrist, Children's Hospital, Southampton

In discussing so complex a subject as the relationship between pædiatrics and psychiatry, one must bear in mind the changing attitude of the physician to disease. There seems little doubt that the physician, whose main concern hitherto was with the diseased organ itself, has now been replaced by one whose interest lies in the total personality of the patient and who sees the patient as a member of a family, of a social group, and in a particular environment. Nowhere is this changing approach more apparent than among pædiatricians. I do not think Professor Wallgren of Stockholm will object if I quote a recent statement of his that 50% of the children in his country who are seen by a pædiatrician, either privately or in the outpatient department, are suffering from psychogenic disorders, and that is not counting those whose illness has produced its own psychological repercussions. Others would put this figure even higher. This is a great change during the last two decades. I would

stress, however, that it is relatively easy to diagnose an illness as psychogenic, much harder to treat it, and harder still to prevent it.

We in this hospital have evolved a joint pædiatric-psychiatric approach. the main features of which are careful preparation of the child and parents by the pædiatrician for further help from the psychiatrist whenever he feels this help is required. Then both specialists carry the case concurrently, seeing the patient at different times (except on ward rounds), but each knowing fully what the other is doing. It is important that a close link be maintained between both specialists throughout. Obviously, to give a simple example, it might well be disastrous if the pædiatrician were to send the child to a convalescent home, or to arrange for the tonsils to be removed, when the psychological side was approaching a crucial stage and family relationships were improving.

Arising from these combined activities it was suggested that research into the ætiology of chorea, spread over ten years, might help to prove whether there really were two types—the psychologically determined and the infective—or whether there was always a mixed ætiology. A plan of investigation was drawn up by the pædiatrician and psychiatrist three years ago, to include the help of the almoner but during these three years other people have also become involved, particularly the Educational Psychologists and the Medical Officer in charge of the EEG department.

In this research plan the child and the parent are asked for their long-term co-operation, and during the survey any therapy that seems advisable is given. 24 cases have been investigated to date. They have all been in-patients, receiving medical treatment, and several, on discharge from the hospital, have been taken over for intensive psychotherapy at the Child Guidance Clinic. Not merely one EEG but a series of investigations are being made. In each case the history includes the antenatal period and the family history. The home life—both physical and emotional—is assessed and the school life, and an initial attempt has been made to come to some conclusion as to:

(*a*) the severity of the chorea and of any other rheumatic infection;

(*b*) the type of personality presented, and

(*c*) the degree of tension or strain or unhealthy living which has occurred in the child's life.

Here briefly is one random case from this series which might help illustrate the approach:

Kathleen, aged 8.—For forty-eight hours before admission she had been extremely restless, with involuntary movement of her arms and legs, and for a fortnight previously she had been noticed dragging her feet as she walked, and had complained of headache. Chorea was diagnosed, and she was admitted to the ward and made an uninterrupted recovery during the following two months, with rest, phenobarbitone and graduated exercise. The B.S.R. was normal throughout, as was the ECG, and there was no evidence of carditis or other rheumatic lesion. The child's EEG was taken and showed no definite evidence of an organic lesion but considerable immaturity.

About three weeks after her admission the mother had a psychiatric interview and proved to be a likeable and attractive young woman who was herself suffering from rheumatoid arthritis. The maternal grandmother had also been arthritic. Kathleen was an only child with devoted but anxious parents. They had expected very high standards of behaviour, and if they did not maintain firm discipline they found she got excitable. The mother welcomed the opportunity to talk over a number of points with the psychiatrist. She herself proved to be a demanding and quietly dominating individual, very involved and mixed in her attitude to her own mother and to her own upbringing.

The child had had a difficult eighteen months before her chorea started; whilst her mother was in hospital she had stayed at first with her grandmother, who resented the lively young child, so she had been brought home to spend the day with neighbours and the night with her father. Her mother, on return from hospital, had been advised to take on a job. She had tried this, but became excessively irritable and fatigued and eventually gave it up.

When the child had a psychiatric interview she referred to past worries about her mother's illness, about a row her mother and a neighbour had had, about a man who had exposed himself to her in a public lavatory and to her present worry about missing school. She was straightforward and quite a forceful personality, very socially mature, but anxious and insecure beneath her poise.

The father, who in his turn blamed himself for his handling of Kathleen whilst his wife was away ill, was a likeable but over-conscientious man.

The almoner visited the home and was shown an immaculately kept house. The mother's illness not Kathleen's, was the more dominant theme.

The patient since discharge from hospital has been seen by an Educational Psychologist in school and given an intelligence test. She is a bright child, her I.Q. being over 120, but she showed a wide scatter, and her school work is very erratic. She is popular there, but easily becomes anxious. The school, an excellent one on the emotional side, from the standpoint of general atmosphere, is not so fortunate in its premises.

Kathleen, when she last attended outpatients a few weeks ago, showed no evidence of chorea, and was enjoying a full day of activity, and her mother was quite happy about her.

Here we have a not atypical picture, with no organic findings of rheumatism, solely the chorea, and unquestionable evidence of tension and strain before her illness. With the family story of arthritis will this child later be admitted with carditis or some other rheumatic lesion? If so, is one to consider that her illness was essentially of psychological origin or was it somatic?

To pass from the particular to the general, almost all these children with chorea have shown some anxiety about school work, and have had periods of poor sleep before the onset of their illness, and there is a frequently recurring pattern in the home, of emotional deprivation.

Many branches of medicine have become increasingly independent of each other during the last twenty years, but perhaps for that very reason they are once more forced to become interdependent, each branch contributing its particular quota of knowledge and experience. It seems in this way only that the maximum understanding of psychosomatic illness can be obtained.

Mental Backwardness as a Pædiatric Problem

By GEORGE ORMISTON, M.D., F.R.C.P.Ed.

Pædiatrician to Southampton and Winchester Group Hospitals

I WISH to report a study of about 200 infants and children who have come under my care for acute or chronic nervous disorders, involving a greater or lesser degree of mental backwardness. An opinion has been sought as to the cause *inter alia* of the backwardness, prognosis, treatment and disposal, and this has compelled an interest in an aspect of pædiatric medicine that does not seem to have received much attention. For there is a tendency to fob off abnormal mental states as difficult to understand and remedy, and belonging properly to the domain of a specialist in the subject.

In attempting to place cases of mental backwardness into some sort of category it is natural to try and decide whether they are due to (1) antenatal factors, (2) birth injury, or (3) postnatal disease, and accordingly I have grouped my cases as follows:

		No. cases	
I.	Mental Defect Resulting from Antenatal Factors:		
	(*a*) Genetic		
	Primary amentia	75	Primary
	Spastic diplegia	6	
	Tuberose sclerosis	2	
	Tay Sachs disease	1	
	Hypertelorism	1	
	Oxycephaly	4	
	Mongolism	48	
	(*b*) Morbidity in mother or fœtus:		
	Kernicterus	4	
	Congenital hydrocephalus	2	
	Congenital microcephalus	1	
	Spastic diplegia due to hæmorrhage or cerebral anoxia during pregnancy	2	
	Endocrine dysfunction (cretins, &c.)	9	
II.	Birth Injury	24	Secondary
	Resulting mental defect in	16	
III.	Postnatal Disease:		
	Encephalitis	9	
	Meningitis	4	
	Infantile hemiplegia	3	
IV.	"Backwardness" resulting from congenital blindness and deafness; and from talipes, cleft palate and long hospitalization	—	

MENTAL DEFECT RESULTING FROM ANTENATAL FACTORS

No definite cause can be identified in genetic types of amentia. Presumably an inherent error affects the structure or function of the neurones resulting in a varying degree of amentia or spasticity or a combination of them, depending upon the regions of the brain involved. In the series there are 75 cases of "pure" mental defect, and 6 of spastic diplegia not attributable to mechanical causes or disease before, at, or after birth.

Primary amentia.—Criteria of diagnosis excluded a history of abnormal pregnancy, birth injury, and need for resuscitation; and clinical evidence of disease affecting the central nervous system.

A family history of mental illness was obtained in 20 cases, denied in 35, and unknown in 20. The incidence of 27% is probably an underestimate and is likely to be much higher than the incidence of mental disease in 75 families taken at random.

40% of the children were first born. Males preponderated in a ratio of 4 to 3. Neither order of birth nor sex contributes to the incidence of primary amentia; nor do maternal age or birth weight, for only 4 of the backward children were born to mothers over 40, while only 2 weighed under 5 lb. at birth and only 2 were over 9 lb.

36% of the 75 children had major or minor fits at some time or other, apparently unrelated to the degree of amentia, except perhaps in the newborn. For when fits began soon after birth and could not be imputed to birth injury, and continued unaffected by sedatives, they often proved subsequently to be associated with a severe degree of mental defect.

Abnormal changes in the electro-encephalogram were found in 11 of 23 cases, chiefly affecting those subject to seizures. Air encephalograms were done in 38 and alterations of a pathological kind were considered to be present in 20.

Approximately 43% were idiotic and helpless; 24% only a degree better, able to get about but ineducable; 19% were low-grade morons fit only for some sort of recreation at occupation centres; while the remaining 14% were high-grade morons teachable at special schools. The chief difficulty in the recognition of amentia concerns children aged 6 to 12 months; and those between 1 and 3 years where the backwardness is moderate or slight. Correct assessment demands a good deal of experience and some knowledge of what Gesell (1941) describes as motor characteristics, adaptive behaviour, language and social behaviour—though the detailed investigations made by this author are beyond the time at disposal in an out-patient department.

The 75 children have been followed for periods up to six years. 49 of them (65%) are living at home. 14 (19%) are dead. 7 are in institutions for mental defectives. Only 10 children altogether (13%) have been admitted to institutions.

Spastic diplegias.—In my opinion spastic children with a history of a normal pregnancy and birth, without need of resuscitation, fall into the same category as the primary amentias. Apart from the spasticity there is nothing referable to the mental defect, maternal age, birth weight, fits, family history and encephalography which distinguishes them from the primary amentias.

Other "genetic" amentias.—Mental defect is a component of the syndrome in tuberose sclerosis, hypertelorism, amaurotic idiocy, &c. The identification of a particular degree or quality of amentia might be made from the analysis of a large series of each of these conditions. It appears that a moderate as well as a severe degree of amentia may be found in tuberose sclerosis and hypertelorism. In oxycephaly the mental defect is less severe and in some cases the mentality is normal.

Morbidity in mother or fœtus.—In kernicterus the mental defect is not inherited but results from a pathological process during intra-uterine life. Two cases suffered complete amentia and died at 3 and 2 years. Two are alive and less affected. One aged 16 now works in a laundry. The other aged 9 lives at home and rides a bicycle with facility. Both have a tremor and some ataxia and were late in physical development.

Mental Defect Resulting from Birth Injury

16 of the 24 cases of intracranial birth injury suffer from some degree of mental defect. In 5 there is backwardness without spasticity. In 11 there is both. 6 or 37% of the backward children are severely retarded (cf. 67% primary aments). 12 or 75% of them were first-born (cf. 40% primary aments). 14 or 87% of the children with birth injury and amentia have suffered from fits (cf. 36% primary aments), and electro-encephalography closely reflected this in abnormal readings. It is apparent that severe mental defect may occur as a result of birth injury, but not so frequently as in primary amentia.

Amentia Due to Postnatal Disease

4 cases of amentia followed meningococcal and influenzal meningitis. All become complete aments. Of 2 cases of infantile hemiplegia with residual paresis, one is mentally normal and the other is backward. Only 3 of 9 children who suffered from encephalitis are mentally normal—1 after vaccination and 2 after whooping cough are moderately backward and 3 who had encephalitis due to measles, rubella and an unknown virus are complete aments.

To conclude this short and incomplete survey of a large group of cases of variable ætiology and pathology that have mental backwardness in common, I suggest that:

(1) Pædiatric teaching and training do not sufficiently take into account the wide prevalence of mental defect inherited, or acquired in infancy, so that pædiatricians are initially ill-equipped to make a comprehensive diagnosis and to deal adequately with the various aspects of the problems presented.

(2) Considering the baneful effects of diseases and injuries that effect the nervous system before birth and subsequently, our approach to them should be governed at all times by a due sense of urgency.

(3) The figures quoted as to the fate of the mentally defective children under observation in this part of Hampshire can probably be applied to the country at large. 65% of the children live at home, open to neglect or cruelty, many a helpless drag on their parents, and some a source of mental or physical trauma to brothers or sisters, when they should be cared for in institutions. The implications of this state of affairs provides a social problem of much importance to the nation.

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Section of the History of Medicine

President—The Right Hon. Lord WEBB-JOHNSON, G.C.V.O., C.B.E., D.S.O., T.D., M.B., F.R.C.S., LL.D.

[*May* 5, 1954]

Christopher Merrett, F.R.C.P. (1614–1695), First Harveian Librarian

By Professor Sir CHARLES DODDS, M.V.O., M.D., F.R.C.P., F.R.S.

BORN in 1614 and dying in 1695, the life of Christopher Merrett covers one of the most important periods in history. From the general historical angle it covers that period of the Civil War and the Restoration, a period so difficult to understand to-day unless one proceeds to the original sources. Merrett's life-period also covered a critical stage in the history of the Royal College of Physicians, and indeed of the history of medicine of the world, for it was at this time that the great Harvey revolutionized the whole outlook of medicine by his establishment of the circulation of the blood. It can truly be said that modern medicine was born at this discovery. This same period is also of the greatest importance to science since it saw the birth of the Royal Society and the establishment and recognition of the experimental method in science generally. It is difficult for the general reader to-day to appreciate the conditions of life in the time of Merrett but for those who wish to get an accurate view, I would recommend the two scholarly works of my former colleague in the library of the Royal College of Physicians, namely *Hamey, the Stranger* and *The Stranger's Son* by Dr. John Keevil. The brief facts of Merrett's life can be taken from the *Dictionary of National Biography* and there we read that he was educated at Gloucester Hall, Oxford, became a Fellow of the Royal College of Physicians in 1651, Goulstonian lecturer in 1654, was a Censor seven times between 1657 and 1670, was an Elect of the College and was its first librarian. He was expelled from the College, officially for non-attendance, and was the subject of a long and bitter lawsuit between the College and himself. He died on August 19, 1695, and is buried 12 feet deep in the Church of St. Andrew's, Holborn. He published a number of works on botany and historical subjects, but none of these is of great interest.

Behind this rather dry summary is concealed a very dramatic and interesting story, but before proceeding with it one must take a little time to sketch the background, particularly from the point of view of the College of Physicians at the time. The College was founded in the year 1518, under a Charter from Henry VIII for regularizing the control of practice in the country. Prior to this date the Universities of Oxford and Cambridge granted degrees in medicine and many of the more successful doctors possessed these degrees. In addition to these there was a constant influx of scholars and doctors from the Continent and these all practised without any preliminary examination or licensing. The first duty of the newly-formed College was to examine the credentials of persons claiming to have medical knowledge and to issue to them licences to practise. A detailed description of this work is contained in the Annals of the Royal College of Physicians. These were fortunately preserved from the fire—entirely due to Dr. Merrett's initiative—and a study of these documents shows that the whole work of the College was taken up in this examining of the credentials of candidates for the licence to practise.

At the period of which I am writing, the College of Physicians no longer met in the "Stone House", No. 5, Knight Rider Street, which had originally belonged to Linacre, and had been their home for nearly a century, for it had become necessary to move to new premises at Amen Corner in 1614.

Here more ample accommodation was available for the library, which included gifts of books from Linacre and Gilbert. It is recorded that the most important gift at this hour was of 680 volumes from the library of a Dr. Holsbosch, a German who practised both surgery and medicine in London up to about 1630. As far as can be gathered he had no connexion with the College, and it is presumed that his bequest was the result of some personal friendship with a Fellow. Dr. Harvey himself always showed the very greatest interest in the library and in the year 1632 he drew up the first set of rules to govern its conduct. The extension to the College was made to house the growing library and this was opened formally on February 2, 1653, and was generally assumed to be Harvey's gift to the College. It was at Harvey's own suggestion that Dr. Christopher Merrett was appointed the first keeper of the library. Prior to this Merrett lived in the College and acted as a kind of housekeeper, or manager. His position was regularized and he was given, in addition to free lodging, a remittance of taxes and a salary. He was very popular and was a personal friend of Harvey. So great was Harvey's interest in the library that in the year 1656 he established a trust whereby he conveyed property to the College which was to bring in an income to maintain a permanent official who was to act as keeper of the library. He was also to have a residence in the College and to receive the sum of £20 per annum to begin immediately after Harvey's death. A study of the Annals fails to reveal any record that Merrett

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was actually formally appointed but there is no doubt that he continued to act in this office and was actually referred to in Goodall *On College Affairs* as the Harveian Librarian. The records show that Merrett was a very successful librarian and under his guidance the library greatly increased in size. Many gifts were received including a very generous donation in 1665 of one hundred pounds from the Marquess of Dorchester. A complete catalogue of the library before the fire listing some 1,300 volumes still exists. It was prepared by Merrett and was printed in 1660. One of these survives in the British Museum; and a typescript copy is in the College. Let us pause for a moment and try to get a picture of Dr. Merrett at this time before the fire.

Born in the county of Gloucestershire on February 16, 1614, he entered Gloucester Hall, Oxford, in 1631. This college was a very ancient foundation, having been incorporated in the year 1283. It was a monastic foundation and on the dissolution of the monasteries it was purchased as a private house but later turned into a college and eventually incorporated as Worcester College, Oxford, in 1714. After a brief stay at Gloucester Hall, Merrett went to Oriel College where he graduated as a Bachelor of Arts in 1635. He returned to Gloucester Hall and studied medicine and was created a doctor in the Faculty of Physic in 1643. He then came to London and was elected a Fellow of the College of Physicians and developed a very considerable private practice. Like most physicians of the day Merrett was very interested in science and became a botanist of some repute. It was only natural that he was attracted to that group of men who formed the Royal Society. This body was really founded by Boyle and his friends in about the year 1645. It was known as the "invisible College" as it used to meet at various places. The first official record of the foundation of the Royal Society was at a meeting on December 5, 1660, when Merrett's name is included amongst those present. The official incorporation occurred on May 20, 1663, when Merrett's name appears as one of the original Fellows. That he took an active part in the Society is clearly shown from a study of the early records. The work of the Society was done by a series of Committees of which there were eight in number. Strange to say, Merrett was Chairman of the sixth Committee which was for the histories of trade. The Committees used to meet at the homes of the various Chairmen and it was only natural that when Merrett's turn came the meeting took place in his apartment at the Royal College of Physicians. It is thus interesting to think that some of the meetings of the Royal Society did take place at the College.

Merrett was a fairly voluminous writer and wrote on such a variety of subjects that it is difficult to understand how he obtained such a reputation in medicine, for he was a very successful clinician. His most important botanical work was his *Pinax* which was dedicated to his friend Dr. Baldwin Hamey. The *Pinax* contains descriptions of flowers, plants, &c., many of which Merrett thought were original. A careful study, however, a few years after his death showed that many of the species had actually been described before. We can picture Merrett, therefore, as a very successful man enjoying his life as a clinician, respected at the College where not only was he a Censor, but an Elect. Apart from the President, this was the highest office in the College and as such he would have a say in the election of the President, and, had things developed differently, might even have occupied this office himself. That he was well looked upon there can be no doubt as shown by his personal friendship with Harvey and also with Harvey's greatest intimate friend, Dr. Baldwin Hamey. All went well until the year 1665, when the Great Plague struck the City of London (*see The Great Plague of London in 1665*, by Walter G. Bell, London). When it became obvious that the outbreak was a major one, a very large number of people left the City of London, in fact most of the wealthy people, merchants, aristocracy and so forth, went to their country residences at the earliest possible moment and with them went the fashionable physicians. The College of Physicians was deserted and only Dr. Merrett, the Harveian Librarian and Keeper of the College, remained. Fear for his family made him desert the College and go to the country, but before doing so he collected the College treasures and, together with one thousand pounds in cash, secured them in an iron treasure chest. That the College was left alone must have been known to thieves because shortly after Merrett's departure they broke in, burst the safe open and stole the plate and the money. The caduceus presented by John Caius in 1556 could not have been in this chest, otherwise it would have followed the rest of the plate, and it is presumed that it was possibly at the house of the President as was the custom in those days. The thieves were never brought to book and, although it was suspected that it might have been the workmen or possibly the chemist who was employed to look at drugs, no trace of the missing plate and valuables was ever found. It is rather pathetic that at a later date it was suggested that Merrett himself had been connected with the theft, but this was only at the height of the action which I will describe later. Merrett returned later in the year and tried to set the College in order, but no sooner had he returned than the Great Fire of London started. By the evening of September 3, 1666, vast clouds of smoke filled the sky and watchers from a distance could see the bright glare of the burning city. By the evening of September 4, the fire had spread to the region of Amen Corner and Christopher Merrett saw without doubt that the College was doomed. His first thoughts were for the College treasures. Assisted by the bedel he personally carried out a number of valuable books, estimated at about 148. He also removed the chest and, most fortunate of all, succeeded in rescuing all the volumes of the Annals. Realizing that he could not save all the books, Merrett picked out the most important and removed these to a safe distance. It is important at this juncture to emphasize that Merrett thought nothing at all for himself, and his own library, which was a famous and extensive one, perished

in toto, also the furniture and his own plate with it. A vivid description of the terrible night was given by Dr. Merrett's son many years later when he gave evidence in Chancery during the course of the legal action. The son says that the College was burnt down between 3 and 4 o'clock on Tuesday, 4th, and that the day before his father had sorted out the books and put the best ones in the College yard in readiness to remove them. The son says that his father was definitely the last person in the College and he gives a dramatic picture of his father walking down Warwick Lane, which was on fire on both sides, with arms full of books followed by the bedel. From that moment everything seems to have gone wrong with Merrett. It has been suggested that the other College officers, who were not present and therefore played no part, felt a little self-conscious and covered their behaviour by attacking the unfortunate Merrett. He was blamed for the loss of books and severely censured for not saving more. Having no home, and in fact no possessions other than those mentioned, the College in 1669 compounded with the Dean and Chapter of St. Paul's for the surrender of their lease and Merrett was paid fifty pounds out of the five hundred and fifty pounds that the College acquired. As far as one can judge from the College records it would appear that everyone including Merrett was satisfied with this settlement. We find no detailed record until September 30, 1681, when he was voted *non-socius* which amounted to expulsion from his Fellowship and the reason given was failure to attend the meetings of the College. There is evidence from contemporary writings that he had developed a bitter antagonism towards the College and actually refused to give up the possessions that he had rescued from the fire. The then President, Sir John Micklethwaite, brought the matter into the open by bringing an action against Merrett on January 21, 1681. Merrett immediately replied with a cross bill. Thus commenced the unfortunate and complicated legal proceedings that have left a mark on the history of the office of Harveian Librarian. The trial was extremely complicated from the legal point of view and lasted two years. Merrett, in effect, lost the action and was ordered to restore to the College all the valuables that he had rescued from the fire. The action before the Chancery Court is fully documented and includes the sworn statement made by Merrett as to the articles in his possession. This included some 148 books, a case of surgical instruments, Dr. Fox's and Dr. Harvey's pictures, both of these having been cut out of the frames by Merrett himself on the dreadful night of September 4. In addition, a mace was also saved and a vellum book containing the names of benefactors of the library. A Persian carpet and a ballot box completed the list.

We know little of Dr. Merrett's life after the legal action. It is believed that he continued to practise medicine, which, of course, he was still entitled to do as he was still a member of the College. He continued to appear at meetings of the Royal Society, but never again was on amiable terms with the College. He made one attempt to obtain the return of his Fellowship but this was immediately dismissed.

When the new College in Warwick Lane, designed by Robert Hooke, was begun in 1670 and completed some years later, it would appear that little provision was made for the library, since the receipt of the excellent collection of the Marquess of Dorchester was delayed until a special room had been built to house it.

This library, consisting of some 3,000 volumes, together with the original catalogue, is preserved almost intact in the present College. Those that are lacking probably disappeared when the College was moved from Warwick Lane to its present site, a fact which may be inferred from the inclusion of these books in the 1755 catalogue of the library, and their omission from the 1912 catalogue.

Considerable work was done on the identification of the pre-fire books about 1930, while ten years earlier an attempt was made to identify the volumes comprising the Dorchester library. Unhappily the results of this work were not available when it was recently decided to shelve the Dorchester library as a separate collection, and as far as possible in the order of the original catalogue of that library. This work has now been completed and a suitably worded tablet erected to commemorate the generous gift of the Marquess.

In looking back on this unfortunate story one cannot help feeling that many of the writers have stressed Merrett's bad points and have passed very lightly over his good ones. Again it is very strange that he should have been harshly treated when men of the calibre of Scarborough and Ent were powers in the College.

In conclusion let us remember that, but for Merrett, we should be without the first four volumes of the Annals.

It is a great pleasure to acknowledge the help of my colleague, Mr. L. M. Payne, the assistant librarian of the Royal College of Physicians. Much of the information has been derived from records and works in the library of the College. The following references have been consulted:

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Two Eighteenth Century Liverpool Surgeons—Park and Alanson

By J. B. OLDHAM, V.R.D., F.R.C.S., Q.H.S.

HENRY PARK

HENRY PARK, born in Water Street, Liverpool, on March 2, 1744, was the son of a well-known physician and surgeon in the town. At the age of 14 he was apprenticed to his uncle—Mr. Bromfield, a surgeon to the Infirmary—and remained with him for three years. During his apprenticeship the Seven Years' War with France, which had started in 1756, was in progress and there was a large number of French prisoners in a depot in Liverpool. Mr. Bromfield was nominally in medical charge of these prisoners, but their treatment seems to have been left to young Park who at times had as many as 600 prisoners under his care. By strict attention to sanitation and diet, he kept the mortality rate below the average of the population, a remarkable achievement in those days when the death-rate in prisons was shockingly high. His kindness won the gratitude of the prisoners which they showed by the gift of multitudes of those knick-knacks, the manufacture of which has always played such an important part in the lives of prisoners-of-war.

Park left Mr. Bromfield in order to go to London, where for three years he was resident pupil of Percival Pott, Surgeon to St. Bartholomew's, and after that he went to Rouen as a pupil of M. le Cat. Returning to Liverpool he set up in practice and, in 1767, when only 23 years of age, was appointed surgeon to the Infirmary, a post which he was to hold for thirty-one years. In 1776 he married and " to get some way out of the bustle and smoke of the town " moved to Basnett Street, now in the centre of the shopping area of the city and less than half a mile from the Pier Head but then considered so far away from the town that his friends advised him against this move as they feared he would endanger his practice. The move, however, was a great success and the following year his friend and colleague, Alanson, joined him in partnership and went to live with him in Basnett Street.

The operation with which Park's name will ever remain connected is the excision of the knee and elbow joints for chronic infection. A little time before 1780 it occurred to him that in some affections of the knee and elbow joints in which amputation had hitherto been necessary, surgery had another resource not yet attempted by which the limbs " might be preserved with such a share of the motions which Nature had originally allotted to them as to be considerably more useful than any invention which Art has hitherto been able to substitute in their stead ". The expedient he suggested was "a total extirpation of the articulation". His plans were well considered and carefully tried out in the post-mortem room.

The first patient on whom he performed excision of the knee-joint was a Scottish sailor aged 33, who had had a tuberculous infection of the knee for ten years. The joint was flexed to a right angle and was so excruciatingly painful that the patient begged to have it amputated. Park explained the possible alternative, excision of the joint, and the patient agreed to this. When we consider the absence of asepsis and anæsthesia and the magnitude of the procedure, we must indeed admire the bravery of both the patient and the surgeon.

The operation was performed on July 2, 1781. An incision was made from 2 in. above the patella to 2 in. below it, and the patella removed. Finding the incision insufficient, Park made a second one transversely across the centre of the first. The femur was sawn through above the condyles, rather more than 2 in. being removed. The upper $\frac{3}{4}$ in. of the tibia was then removed and as much as possible of the capsule and lining of the joint. The bones were brought into alignment, the edges of the wound drawn together with a few stitches, dressings applied and the limb splinted.

The convalescence was stormy until, at the end of October, Park moved the patient to a farmhouse a few miles out in the country. From then on progress was rapid and by the end of the year the callus was firm. In March the patient fell and broke the leg, but within twelve months of the operation he was walking without a stick and, later, returned to sea. He continued as a sailor, going aloft without difficulty, but a few years later was drowned when the ship he was in sank in the Mersey.

Park published in 1783 an account of his researches and his successful operation in the form of a letter to his old teacher Percival Pott. In this country little notice was taken of Park's work, but his paper was translated into French in 1784 and a M. Moreau adopted the idea and successfully excised several elbow, knee, ankle, tarsal and shoulder joints. Reports of these cases published by M. Moreau's son, who paid generous tribute to the pioneer work of Park, were read by Mr. Jeffray, Professor of Surgery in Glasgow, and were translated by him for the use of his students. He published this translation together with his observations in a book in 1806, which contained also a reprint of Park's original paper, a reprint of a paper by Park published in the *London Medical Journal* in 1789 giving

an account of his second excision of a knee-joint—this patient died of toxæmia three months after the operation—and Park's *Subsequent Observations*.

In these *Observations* Park reviews Moreau's work and describes some of his own cases of excision of the elbow-joint, and his treatment of compound dislocations of joints.

Park was an accoucheur and physician as well as a surgeon, and during the whole of his career he kept a careful account of all the midwifery cases he attended. The accuracy of this register, which he called his *Book of Genesis*, is remarkable and has often supplied information which the imperfect parish registers failed to give.

The book, which is the treasured possession of the Liverpool Medical Institution, records 4,000 births and contains the names of all classes from the titled to the lowly. Among other entries is that of the birth of William Ewart Gladstone on December 29, 1809, at 62 Rodney Street.

Apart from his professional attainments, Mr. Park was held in the highest estimation. He was one of the best-known men in the town with his short, round figure and bright, good-natured face and his never-failing flow of good spirits. He must have had an extraordinary constitution for neither fatigue, nor cold, nor heat, nor wet seemed to make any impression on him. The senior physician to the Infirmary, Dr. Dobson, an enthusiastic research worker and a fellow of the Royal Society, was interested in the physiology of sweating, and in one of his papers to the Royal Society described his experiments in the so-called "sweating room" of the Infirmary, a little room measuring 9 feet in all directions. In one of these experiments it is recorded that when the room was heated up to 202° F. Park went in and remained inside while 3 eggs were cooked solely by the heat of the room; he ate the eggs and then walked to Everton some miles away in a hard frost without coming to any harm.

We see Park again as the amiable colleague in association with another of the Infirmary Physicians, a Dr. Houlston, who may claim to be a pioneer of Life Saving in this country. Thanks to Houlston's enthusiasm, a Recovery Room for the apparently drowned was established at the docks and awards were offered to those who recovered the victims and brought them to this Recovery Room. On notification, the physicians and surgeons of the Infirmary went to the Recovery House and assisted restorative treatment. In the reprints of the Humane Society we can read of case after case in which this happy band of brothers helped one another in this work. How well they did it can be gauged by their proud record that during the six years from 1776–1782, 107 persons were brought to the Recovery Room and of these 57 recovered completely.

For most of his life Park went about his work on foot or on horseback; he was not a good horseman and had many falls, so that he laughingly claimed that he had broken every bone in his body except one arm and one head.

In 1788 Park left Basnett Street and moved to Bold Street. He continued in active practice up to his 74th year; at that age he retired, but as his *Book of Genesis* shows he continued to take an occasional maternity case up to within a year before his death.

In 1830 his health began to fail and he realized all too clearly that he had a cancer of the stomach. In this, his last—and almost his first—illness, all that was most brave and kindly in his nature came brightly out. He remained as genial and social as in his hours of health, calmly arranged for the interest of his relatives, his old servant and for his horses and dogs, and at last he died on January 28, 1831, in his 86th year.

EDWARD ALANSON

Edward Alanson, born in 1747, was the son of a well-to-do farmer in Newton. He came to Liverpool in 1763 when he was 16, and was apprenticed to Mr. William Pickering, the senior surgeon of the Infirmary, whose house was in James Street. He lived with the Pickering family and worked as Mr. Pickering's assistant in his private practice and at the Infirmary for five years.

In 1768 he went to London and for two years was the pupil of John Hunter. Alanson was one of Hunter's earliest pupils and among his fellow-students was Edward Jenner.

Alanson, like Park, never really qualified; he had no University training or degree and probably all he had to show was a certificate of attendance at St. George's Hospital.

After his two years' training Alanson returned to Liverpool, bringing with him a specimen which he had injected and dissected when he was with Hunter. This specimen is still in the Anatomical Museum at Liverpool University. Almost immediately, when he was still only 23, he was appointed surgeon to the Infirmary. He continued to live with Mr. Pickering, practising from his house, but in 1774 he moved to Cable Street. The following year he married and in 1777 he joined his friend and colleague, Henry Park, and moved to his house in Basnett Street.

Alanson made his name as a young man. He was only 32 when in 1779 he published the first edition of his book, *Practical Observations on Amputations and the After Treatment*. This is one of the classics of surgery. Alanson records first the methods then commonly employed in amputation and tells how, of 46 amputations at which he assisted, 10 died; 1 of tetanus, 2 of hæmorrhage, 4 of sepsis and 3 of gangrene of the stump. Of those that recovered, in all there was severe infection, in most the bone protruded from the stump and many remained unhealed. He then described his own technique, step by step, giving in detail his reasons for differing from the usual methods.

Previous to Alanson's work, no particular effort was made to preserve enough skin to cover the stump. A circular incision was made round the limb through the skin which was drawn up by the assistant; a further incision was made at the level of the retracted skin through the muscles down to the bone; the periosteum was then stripped off the bone for some distance above and below the line through which the bone was to be sawn. After the amputation was completed, arteries, veins, nerves and surrounding muscles were transfixed and ligatured *en masse*.

Alanson carefully estimated the amount of skin that would be needed to cover the surface of the stump with perfect ease and marked the limb with ink as a guide for his incision. When he was cutting the muscles he did not go straight down to the bone but cut through them obliquely so that he reached the bone three or four fingerbreadths above the cut edge of the deep fascia. He pointed out the folly of stripping the periosteum over a wide area; instead he merely divided it with a knife where he was going to saw through the bone. He noted that mass ligature encouraged pain, spasms and necrosis, and he insisted that each blood vessel should be taken up with forceps and tied separately, taking care not to ligature the nerves. He washed his hands carefully before starting to operate and he bathed the wound with warm water at the end.

It was the custom then to dress amputation stumps by applying dry lint to the wound surface, and many surgeons were in the habit of applying flour to stop the bleeding. No effort was made to bring the skin down over the end of the stump until the post-operative suppuration had settled. Alanson pointed out that unless the skin was brought down immediately it would be fixed by adhesions and inflammatory œdema and he, therefore, brought it down at the end of the operation and fixed the edges as a thin line across the end of the wound with sticking plaster or stitches. He observed that when dry lint was put in contact with the raw stump, spasms, pain, inflammation, hæmorrhages and slow healing were the rule. He preached the need for covering all wounds completely with skin if healing by first intention was to be hoped for; nor did it escape his attention that too much skin was disadvantageous, and that those wounds healed best where the skin was such an exact fit that adhesive plaster or stitches were necessary to prevent the edges retracting.

He was able to report 35 amputations of the thigh without a death, all but one healed perfectly and most of them by first intention. This would be a good achievement to-day; only a great surgeon could have got such good results 175 years ago.

A second and much enlarged edition of his work was published in 1782. The first part of this book, which extends to 296 pages, is a repetition of the original pamphlet and nearly 60 pages are given to a description of cases of amputation through the lower leg using a posterior skin and muscle flap. Then follows lucid and detailed instructions for amputating fingers and toes, using flaps; and accounts of amputations through the shoulder-joint. The last 100 pages give the histories of numerous cases of amputations through the thigh; 9 of these were performed by other surgeons using Alanson's technique, and the remainder Alanson did himself.

The most interesting and remarkable section in the whole volume is entitled *Miscellaneous Observations on Amputations and the Air of Hospitals*. In this chapter Alanson shows that he was as far ahead of his times in his views on sanitation and hygiene as he was on amputations.

He calls attention to how much better patients progressed after operations done in the country than in crowded city hospitals, and he then suggests a series of regulations, 16 in number, for the consideration of those who are in charge of hospitals.

He recommended that no ward should be occupied for more than four months, and that its walls should then be scraped and white-washed before patients were readmitted. He advised that the beds should be made of iron to prevent the lodgement of vermin and to ease their sterilization. He advised, too, frequent changing of the bedding and that where possible it should be taken out of doors and exposed to the air for several hours daily. Those patients who came from dirty surroundings, whose clothing was dirty or who were verminous, were to be stripped, washed in warm water and provided with clean clothes. He recommended the building of an oven in which infected clothing could be baked to destroy vermin and infection, the clean clothes being returned to the patients when they were discharged from the wards. All incurable or very infectious cases were to be refused admission, and those with offensive or putrid sores he advised should be isolated in special wards. Special rooms were to be provided for operation cases, and these rooms were to be the brightest and most airy in the hospital, and were to be cleaned and ventilated frequently.

He advised that hospitals should be made large enough to allow some part of the building always to be unoccupied, so that it could be whitewashed and cleaned.

The nurses were to wash every patient's hands and face daily, and their feet at least once a week, and be liable to a fine if some of the windows in their wards were not kept open during a stated number of hours daily. Finally, he recommended that every Infirmary should have a country branch where patients could be sent for convalescence.

In 1790 Alanson moved to Wavertree, about five miles from the city centre, and four years later, owing to ill-health, he resigned from the Infirmary and retired to Aughton, near Ormskirk, where he practised as a consulting surgeon for some years. In 1808 he returned to Wavertree, where he continued in practice until shortly before his death in 1823.

[*July* 7, 1954]

A Medical Historian in New Zealand and Australia

By Douglas Guthrie, M.D.

The wandering physician was a familiar figure in the early days of medicine. Hippocrates and Galen practised "The Art" in many places. They taught, and also learned, as they moved about. So did Paracelsus, when he roamed all over the Christendom of his day. Much more recently Sir William Osler proved, by his own career, his contention that "permanence of residence, good for the pocket, is not always best for wide mental vision".

The opportunity which came last year to a much more humble disciple of Æsculapius, to deliver some lectures in the Antipodes, was eagerly seized, although involving absence from home for nearly a year. Only a slight background is needed as an introduction to the main concern of this discourse, the position of medical history in the countries visited, and especially the libraries of early medical works, at Dunedin and at Melbourne.

During the long voyage to New Zealand, our first impact with medical history was in the Panama Canal. The Canal is an impressive sight; it is, moreover, a monument to "the most striking experiment in tropical sanitation ever made". One recalled the labours of General Gorgas to convince the authorities that yellow fever was carried by the mosquito, and that the presence of this insect was the main obstacle to the work. Gorgas was responsible for the eventual transformation of the deadly Canal Zone into one of the healthiest parts of the world, as it became when the canal was opened in 1914. Such memories of William Crawford Gorgas led one to think of the perils and hardships endured by early voyagers to New Zealand: of Abel Tasman, for example, who first sighted its shores. Tasman's remarkable map, dated 1644, is preserved in the Mitchell Library at Sydney, and also depicted in mosaic on the floor of the entrance hall.

In this map, Tasmania appears as part of the mainland of Australia, because it was not until 1799 that George Bass, a young naval surgeon, sailed through the strait which now bears his name. Bass was born in 1770, the year of Captain Cook's landing at Botany Bay, a few miles north of Sydney. The achievement of Bass is often overshadowed by that of his associate Matthew Flinders, also a Lincolnshire lad, but there is a well-deserved tribute to his memory, the biography so excellently written by Dr. Keith Bowden [1].

(After a brief reference to the scenery of New Zealand and Australia, the flowers and birds which so impress the visitor, the remarkable fauna, especially that of Australia, and the widely differing Maoris of New Zealand and Aboriginals of Australia, Dr. Guthrie spoke of the Health Services of both countries, comparing them with that of Britain.)

Medical education has now reached a high standard in Australasia, and many of the hospitals and medical schools are in the front rank. It is not surprising that in such an atmosphere of progress History takes a prominent place. Interest in the History of Medicine is keen, and although, as yet, no one has written a comprehensive treatise on the early days of medicine in New Zealand and Australia, there have been many shorter contributions to the subject. For example, Dr. W. E. L. H. Crowther of Hobart, Tasmania, the fourth of a dynasty of doctors, and one whose great-grandfather combined medicine with whaling, and owned his ships, has written several fascinating accounts of the medical history of Tasmania, or Van Diemen's Land as it was called until 1850. Another veteran whose pen has been active is Dr. Robert Scot Skirving of Sydney, who is believed to be the oldest living medical graduate of Edinburgh University. We found him still alert and active at the age of 94. My wife and I were honoured to be his guests at dinner, when he spoke of his life at Edinburgh in the '80s of last century and of his experiences as house-surgeon to Professor Spence. Next day, he gave a lecture to the Post-graduate Class at Prince Alfred Hospital on *Pneumonia, then and now*, contrasting the early treatment with present-day methods. He, too, has contributed to our knowledge of the early medical pioneers. Other medical historians of Sydney are Professor Edward Ford, the owner of an extensive library of Australiana, and Dr. MacArthur Brown of Parramatta, Lecturer on History of Medicine in the University of Sydney, who like his father and grandfather practises as a physician in Parramatta. An even larger coterie of medical historians is to be found at Melbourne, including Drs. Colin Macdonald, Roland Wettenhall, Boyd Graham, Douglas MacArthur, Kenneth Russell Younger Ross, Keith Bowden and the energetic secretary of the group, Bryan Gandevia. Melbourne may well be proud of its medical historians, as indeed it is proud of the medico-historical libraries which are housed in the Royal Australasian College of Surgeons. One is the historical section of the Gordon Craig Library, the other is the Cowlishaw Library. Gordon Craig was a surgeon in Sydney, a graduate of Glasgow University who bequeathed £30,000 to the College in order to found a library. The historical part of that library contains about 250 books. Besides biographies, histories and works relating to medical history, there are some early books, including those of Peter Lowe, Ambroise Paré, Richard Wiseman, William Cheselden and others. A dozen books from the library of Rudyard Kipling, presented by his widow, bear Kipling's book-plate. They include Gerard's Herbal, 1633, and Culpeper's Herbal, 1653. The only manuscript is a two-volume set of Notes of

the Lectures on Anatomy and Surgery given by William Hunter at the Windmill Street School, taken down by a student in 1774.

Housed in the same building, but in separate bookcases, is the library of Dr. Leslie Cowlishaw. It was purchased by the College in 1943, after the death of Dr. Cowlishaw, a Sydney physician who was keenly interested in the history of medicine, and had written many excellent papers on the subject. The library contains about 500 books published before 1850 and 1,000 subsequent to that date. The latter section contains most of the important histories, biographies, and other medico-historical works of the period. Among the earlier works are eight *incunabula*, in unusually perfect condition. They include two copies of the *Canon* of Avicenna, printed in 1479 and 1498, the famous encyclopædia of Bartholomeus Anglicus, dated 1483, the works of Rhazes, 1497, the little poem, *De Urinis et Pulsu*, 1495, by Gillies de Corbeil, and the 1493 edition of Celsus' *De Re Medicina*, of which more than 100 printed editions have appeared. (There are twenty of them in the Library.)

Two famous early works on surgery complete the list of *incunabula*: the *Cyrurgia* of Guy de Chauliac (Italian edition, 1499), and the *Cirurgia* of Guy's distinguished pupil Pietro de Argellata, also 1499. Space allows only a brief mention of the many rare early medical works, after 1500. As one example, domestic medicine is represented by Andrew Boorde's *Breviarie of Health*, Sir T. Elyot's *Castel of Helth*, T. Cogan's *Haven of Health* and John Wesley's *Primitive Physick*. Of local interest is the Australian edition of Jenner's *Enquiry into the Causes and Effects of Variolæ Vaccinæ*, printed in 1800 in Sydney, as a Government Publication. Some of the rarer works on anatomy have been described by Professor Russell in the *Medical Journal of Australia* [2]. They include the German edition of Vesalius' *Fabrica* called *Anatomia Deutsch*, 1551, also the pre-Vesalian treatise of Berengario da Carpi of Bologna in an English translation entitled *Microcosmographia*, 1664. It contains probably the first descriptions of the vermiform appendix and of a horse-shoe kidney. There are also two plagiarized versions of the *Fabrica*, by Valverde, 1556, and by Ryff, 1541, the latter being based upon the *Tabulæ Anatomicæ Sex* which preceded the more famous *Fabrica*. The library has an unusually perfect copy of Remmelin's *Survey of the Microcosme*, as the English translation, dedicated to Samuel Pepys, is entitled. The various structures are shown by means of superimposed flaps, a method still used in first-aid charts. Such an excellent collection of early medical works will certainly promote the study of the history of medicine in Australia.

Dunedin, where, at the Medical School of the University of Otago, medicine has been taught since the 1870s, is the fortunate possessor of a medico-historical collection of great interest. The library of that School contains the books and manuscripts which belonged to the three Alexander Monros who, each in turn, held the Chair of Anatomy at Edinburgh, over a period of 126 years, 1720 to 1846. The first Monro, along with his father John Monro, was the founder of the Faculty of Medicine in Edinburgh University. Monro *secundus* was an anatomist of even greater distinction. The third of the line, Alexander Monro *tertius*, had a son David who graduated in medicine and, after assisting his father for a time, emigrated in 1841 to New Zealand, where he forsook medicine for politics.

He became Speaker in the House of Representatives and was knighted for his services. The books and manuscripts, probably sent to him after his father's death in 1859, remained buried in the Parliamentary Library at Wellington for over fifty years. Then Sir David's grandson, Dr. Charles Monro Hector, had the Collection transferred to the Medical School at Dunedin. It consists of about 250 books and 60 manuscripts. Most of the books deal with anatomy and surgery, and are of eighteenth and early nineteenth century dates. Naturally the greatest interest centres around the works of the Monros themselves, and especially the manuscripts, of which a relatively small number have appeared in print. Among them is an autobiography of Monro *primus*, written in his own hand, a small bound volume of 46 pages, which was added to the Collection in 1938 by Mrs. C. Saxby, sister of the late Dr. Monro Hector. It gives an interesting account of the Monro family, of the foundation of the Faculty of Medicine and the Royal Infirmary of Edinburgh, and of other events of the period. Being undated, written in the third person and somewhat eulogistic, there was at first some doubt as to its authenticity, but there is now little doubt that it is the work of the first Monro [3]. Other interesting items are the lectures *On Wounds*, and *On Tumours*, delivered by Monro *primus* in 1721 and 1722, but never published: two distinct and separate histories of anatomy (one by Monro *primus*, the other by *secundus*), the manuscripts of nearly all the printed works of the three Monros, and 23 volumes of lecture notes by A. Monro *tertius*, suggesting that, contrary to report, he was industrious, at least in his early days. Dunedin may well be proud of the Monro Collection, and it is hoped that further details regarding it may be published.

The significance of these two medico-historical libraries is not yet fully appreciated even in Melbourne and in Dunedin. Nevertheless there is a growing interest in the history of medicine, both in New Zealand and in Australia, and those important sources of information will prove of great value to future generations of students when the need for an historical basis to medical education comes to be recognized.

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Section of Dermatology

President—REGINALD T. BRAIN, M.D., F.R.C.P.

[*April* 29, 1954]

Lymphocytoma.—J. S. PEGUM, M.R.C.P.

Mrs. R. H., aged 74. Housewife.

History.—1924: Developed spots on forehead described as "yellow translucent nodules". In the subsequent years developed similar lesions on the forehead, temples and eyebrows. These lesions were treated with radium and with carbon dioxide snow.

1950: Developed red patch on left temple.

1953: Parts of the red area turned "blistery". The lesions irritate occasionally, especially when exposed to sunlight. She gets spots on the cheeks in springtime, which she attributes to the sun.

General health.—Good.

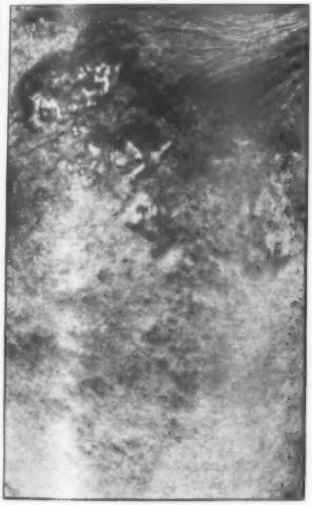

FIG. 1.

On examination (1954).—On left temple and cheek there is an area of bright erythema, in which are set small rounded brown translucent papules of "apple jelly" appearance. Some of these papules are isolated, but those near the hair line are aggregated and confluent (Fig. 1). *Forehead* shows scarring, pigmentation and telangiectasia. The left side of the forehead has a few brown translucent papules on it.

Special investigation.—W.R. negative. Hb. 90%. R.B.C. 5,200,000. W.B.C. 5,500. Blood cholesterol 421 mg./100 ml. X-rays: No focal pulmonary lesion. No evidence of hilar or mediastinal lymphadenopathy. Urine normal.

Histology.—Biopsy from forehead, 1929: Epidermis, rather flattened. Basal layer pigmented. Dermis: dense infiltrate composed of lymphocytes and reticulum cells occupies most of the dermis with the exception of a narrow band immediately under the epidermis.

Biopsy from left temple, 1940: Epidermis normal. Dermis: rounded clumps of infiltrate in mid-dermis. Reticulum cells, lymphocytes and fibroblasts.

Biopsy from left temple, 1954: Rather fragmented piece of skin. Epidermis flattened, pigmented basal layer. Dermal fragments contain dense infiltrate composed of lymphocytes and reticulum cells. There is an indistinct lymph-follicle pattern.

Comment.—This case therefore seems to be follicular lymphocytoma having an appearance of translucent brown papules and with the story suggesting sensitivity to sunlight; the histology confirms that diagnosis.

The length of history is of interest, beginning as it did in 1924—thirty years without any obvious malignant change. Another unusual feature is the raised blood cholesterol; I am not sure of the significance to be attached to this.

Dr. H. R. Vickers: I thought this lesion was consistent with the diagnosis of lymphocytoma. Exposure to sunlight often appears to be a factor in the localization of these lesions. In my experience these lesions respond to treatment with X-ray and there is now no evidence of lymphocytoma remaining in the skin burnt by radium.

Dr. Brian Russell: I suggest this is a benign lymphoma which, in places, simulates the miliary type of lymphocytoma. If this is so, it should respond to X-irradiation in one or two exposures of 250 r on each occasion.

Eosinophilic Granuloma (Erythema Elevatum Diutinum Type).—ARTHUR PORTER, M.D.

Mrs. B., 44 years. No children. Draper's assistant. Complained of marks on face for three years. First lesion noted was that on forehead. Others developed at intervals and progressed slowly.

Past history.—Tendency to nasal catarrh; occasional leucorrhœa. Took two tablets of dried thyroid extract daily for several years before lesions on face appeared.

Family history.—Father and sister's son suffer from hæmophilia.

On examination.—A well-developed healthy-looking woman with five reddish-brown lesions on the forehead and both sides of the face. The lesions are sharply defined, soft, smooth, slightly

elevated and can be moved freely with the skin. They vary in size from 5 mm. to 1·5 cm. The sensation given to the finger tip is that of slight infiltration. She has a few decayed teeth.

Investigations.—W.R. and Kahn reactions negative. Skiagram of skull and long bones normal. Blood count normal (1% eosinophils). Biopsy (Dr. H. Haber): The epidermis is normal. Separated by a band of normal collagen there is a focal infiltration clearly surrounding blood vessels and consisting of round cells, neutrophils and eosinophils. Some vessels show hyalinization of their walls but one can also see the collagen within the infiltration to have undergone hyaline degeneration.

Treatment.—1,500 r was given in divided doses at intervals to a single lesion in the right malar region. There was no improvement.

Discussion.—Eosinophilic granuloma of the skin is generally considered to be a disease *sui generis*. It differs from eosinophilic granuloma of the bones in several ways. The lesions are confined to the skin and occur most frequently on the face in adults. They are usually radio-resistant, do not ulcerate, and show little tendency to heal spontaneously. Histologically also the disorder differs from eosinophilic granuloma of the bones in certain respects. Lever (1949) has drawn attention to the resemblance to erythema elevatum diutinum.

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Dr. H. J. Wallace: The histology resembles erythema elevatum diutinum but both the history and macroscopic appearances of the latter are quite different. The latter waxes and wanes over a long period and is often associated with intermittent systemic upset, including fever. The lesions of erythema elevatum diutinum do not show the fairly characteristic bronzed appearance of the lesion in this patient.

Dr. H. Haber: Eosinophilic granuloma of the face of the erythema elevatum diutinum type is a distinct entity and has to be separated from the reticulo-endotheliosis (Letterer-Siwe, Hand-Schüller-Christian disease and eosinophilic granuloma of bone). Clinically it resembles lupus erythematosus, lymphocytoma or sarcoid. The diagnosis is made histologically. All cases so far described show the same histology as shown in this case. Because of histology similar to that seen in erythema elevatum diutinum, it was called granuloma of "the erythema elevatum diutinum type". But the nosologic position of this condition is unknown.

Purpura Cryoglobulinæmica.—N. A. THORNE, M.D., M.R.C.P. (for BRIAN RUSSELL, M.D., F.R.C.P.).

Mrs. J. B., aged 59.

Four years ago this patient developed nettle rash with irritation on the face when out walking in a cold wind. This has recurred each year during the cold weather. Two years ago she developed purpura, at first on the lower legs, later involving other parts of the body: it has always been worse in cold weather and never completely clears. Apart from the removal of a mixed parotid tumour fifteen years ago her general health has always been good and there is no relevant family history.

On examination.—The positive physical signs were obesity, left ventricular hypertrophy with a blood pressure of 200/110 and many purpuric lesions, especially on the face, buttocks and lower limbs, with a few discrete ones on the palate and uvula. Hess's tourniquet test was positive.

Investigations showed a hæmoglobin of 86% with normal red and white cell counts. Lupus erythematosus cells were not present and there was no deficiency in platelets. The bleeding time has varied from 1 min. 10 sec. to 8 min. 10 sec. and the coagulation time from 37 sec. to 4 min. 30 sec. Total serum proteins were 7·0 grams/100 ml. with an albumin:globulin ratio of 3·8 × 3·2 grams/100 ml. On one occasion the total protein at 37° C. was 6·4 grams while at +5° C. it was reduced to 5·9 grams/100 ml. Cryoglobulin estimation was 0·5 gram/100 ml. Plasma cells were found in the sternal marrow. The E.S.R. (Westergren) was 1 mm. in one hour at 0° C. and 153 mm. in one hour at 37° C. Liver and renal function tests were within normal limits and blood culture was negative. X-ray of the skull showed a well-marked degree of internal frontal hyperporosis. There was no evidence of myelomatosis in X-rays of other selected bones. Biopsy of the skin showed dilatation and congestion of superficial dermal vessels, many of which contained thrombi and showed fibrinoid impregnation of their walls with extravasation of erythrocytes in the surrounding tissues. A block of ice was applied for eight minutes to an area on her forearm which was free from purpura. A male and female control were tested over the same period. On removing the ice there was an erythema of the affected area on the patient's arm which was hotter than the surrounding skin. Three minutes later, many petechiæ appeared. In the case of the two controls, the test area was cooler than the surrounding skin and no petechiæ appeared.

Comment.—The association of cryoglobulins with purpura was first described in Scandinavia by Lehman and Flemberg in 1944. The name Purpura Cryoglobulinæmica was coined by Lerner and Watson who published the results of their work in 1947. They investigated the serum from 121 patients with various diseases and 40 healthy controls. Spontaneous precipitation of globulins in the cold occurred in 31 of the former, but did not occur in any of the control series. Amongst the diseases in which cryoglobulins have been found in the serum are multiple myelomatosis, leukæmia, including lymphatic and aleukæmic types, disseminated lupus erythematosus, subacute bacterial endocarditis, reticulosarcoma, kala-azar and one case of chronic arthritis without signs of myeloma.

In many of the described cases the serum cryoglobulin was below 25 mg./ml., purpura being absent. Where purpura occurred the figure was considerably higher: in Lerner's case the figure was 800 mg./ml.

The cryoglobulins are a group of abnormal proteins with the common property of precipitating or gelifying from cooled serum—if in high concentration this may occur at room temperature. There is no true coagulation since the pseudoclot is easily soluble on warming the plasma or serum. Thus we find that the erythrocyte sedimentation rate is nil at 0° C. and very rapid at 37° C.: this is the opposite to that found with cold agglutinins.

The precipitation of this globulin in the smaller vessels of the skin on cooling has been found to cause: (1) Raynaud-like syndromes with bluish discoloration of the ears, nose and fingers. (2) Purpura with œdema. (3) In very severe cases, ulceration and necrosis of the skin with little tendency to heal.

The majority of cases of cryoglobulinæmia with purpura have occurred in association with multiple myelomatosis. In our case there were no definite diagnostic bony changes: however, the presence of plasma cells in the sternal marrow and the very rapid coagulation time are very suggestive of this being the underlying pathological process.

Most of the reports of this rare abnormality have come from America and Scandinavia and I have been unable to find a recorded case in the United Kingdom.

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Dermatomyositis (Sclerodermatous Phase).—STEPHEN GOLD, M.D.

Miss D. B., aged 52, noticed a tendency for her fingers to become numb and cold seven years ago and the following year her ankles and knees began to ache and feel weak. Soon she found it difficult to get up from the kneeling position and later her arms became weak, so that she found knitting impossible. The pains which developed in her joints became easier after resting. All these symptoms which appeared during the menopause have not progressed over the last year or so. Dysphagia was minimal but present.

On examination.—She was admitted for investigation of her myopathy and the salient abnormal findings were early facial sclerosis and microstomia. The muscle-bulk was diminished in both arms and some hypotonia with diminution of power was apparent in all muscle groups. Weakness of thigh muscles was obvious though their tone was normal; power was impaired in all groups with exception of peroneal muscles and plantar-flexors. She also has a pustular rosacea of the face and neck.

Investigations.—Blood count essentially normal. Chest X-ray reveals active tuberculous infiltration, left upper zone. Urine creatine 150 mg., creatinine 550 mg./twenty-four hours.

Electromyogram.—The picture is that of myogenic atrophy (though the fibrillation is unusual) but the E.M.G. cannot distinguish between true muscular dystrophy and polymyositis such as occurs with scleroderma, dermatomyositis and other collagen diseases.

Barium swallow.—The œsophagus was seen to be normal in width but it lacked any appreciable peristaltic activity. The œsophagus failed to empty the barium with the patient in the lying position. It is considered that this is consistent with the early changes of scleroderma.

The following cases were also shown:

Juvenile Dermatitis Herpetiformis (Two Cases).—Dr. BRIAN RUSSELL.

Keratolymphangioma.—Dr. P. J. FEENY.

Kaposi's Idiopathic Hæmorrhagic Sarcoma (Responding to Penicillin).—Dr. STEPHEN GOLD.

Scleroderma.—Dr. P. D. SAMMAN.

Fibrosarcoma of Multicentric Origin.—Dr. R. G. HOWELL (for Dr. G. B. MITCHELL-HEGGS).

Acrodermatitis Enteropathica.—Dr. I. S. HODGSON-JONES.

Hyperkeratosis Follicularis et Para-follicularis in Cutem Penetrans (Kyrle) with Lesions of the Palms and Soles.—Dr. K. V. SANDERSON.

[*June* 17, 1954]

Pyogenic Granuloma. Multiple Local Recurrence Following Excision.—CLIFFORD EVANS, O.B.E., M.B.

D. L., boy aged 8 years.

In December 1953 his mother noticed a small red raised painless papule on the skin of his back over the lower end of the left scapula. This rapidly increased in size, bled at times and became painful on pressure. When first examined in February 1954, he had a typical pyogenic granuloma 1 cm. in diameter, slightly pedunculated and with a moist infected surface. It was excised under a local

anæsthetic and after a severe local skin reaction to the Elastoplast dressing had subsided the wound healed well. A month later a small red raised papule appeared at the upper end of the scar and within the next week a shower of similar lesions appeared within a 5 cm. radius of the scar (Fig. 1). The largest of these new lesions was excised for histological examination. No more secondary papules have occurred but his mother thinks that some of them have increased in size slightly since they first appeared.

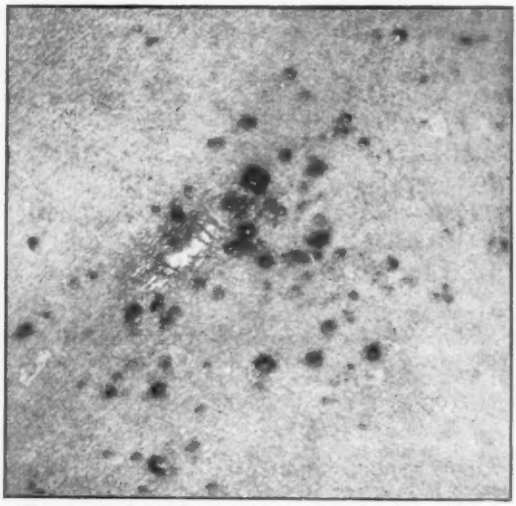

FIG. 1.—Red papules around scar 5 weeks after original excision.

On examination.—Multiple red vascular papules varying in size from those just visible to the naked eye up to about 2 mm. in diameter are present round the excision scar. They fade on pressure.

Investigations.—The original tumour shows the histology of a simple hæmangioendothelioma with the surface ulcerated and infected. The secondary papule has an identical histology except that there is no ulceration or infection.

Comment.—Local cutaneous recurrence following excision of a pyogenic granuloma does not appear to have been reported previously. The histology of pyogenic granuloma and the common hæmangioma seems to be identical; the former may occur at the site of an abrasion or small pustule. In this case there was considerable reaction and some skin infection under the Elastoplast dressing. The secondary lesions are confined to the area covered by the Elastoplast dressing and it appears possible that the trauma and sepsis may have initiated these lesions.

The President: I do not know how common this is but I saw my first case only a few months ago at the Hospital for Sick Children. The primary lesion was said to have been a little brown spot and when we saw the satellite lesions we wondered if it was a melanoma with secondary lesions. The child was admitted as an urgent case and the lesion excised and it was reported as "pyogenic granuloma". The brilliant little red papules were suggestive of granuloma telangiectaticum but I had not seen such a picture before. The lesions were destroyed by diathermy and the recurrence of one or two was successfully treated with trichloracetic acid.

I always remain a little uneasy about our concept of this condition, which is said to have a peculiar histology. The late Dr. M. Lowenberg used to demonstrate a curious thickening of fibrous tissue in the base of this lesion with large vessels running through it and a dense inflammatory infiltrate. It certainly bleeds very freely and I should like to know if anyone has bacteriological evidence to support the view that it is pyogenic.

Dr. J. E. M. Wigley: I wonder if the histologists can tell us what is a pyogenic granuloma? I have always thought it a misleading if not a bad name.

Dr. H. Haber: Trauma or infection seems to play a considerable part in the development of these pedunculated tumours. As a rule the histology is that of chronic granulation tissue containing masses of telangiectatic capillaries to simulate a capillary hæmangioma. If the inflammation is scanty then the diagnosis may be very difficult.

Dr. Brian Russell: I recently saw a woman doctor whose granuloma telangiectaticum developed, so she told me, after she had applied a silver nitrate pencil to a stellate hæmangioma. I believe that "granuloma telangiectaticum vel pyogenicum" is a benign but rapidly growing hæmangioma, initiated by some forms of trauma to dermal vessels.

Dr. D. S. Wilkinson: One finds this so-called pyogenic granuloma frequently arising after trauma but by no means always so. I have never seen it arise from an infantile, spontaneously regressing type of hæmangioma.

Dr. G. C. Wells: Supposing that this is a granuloma telangiectaticum, would it be worth trying the effect of hydrocortisone ointment? Among the conditions which are said to respond to hydrocortisone ointment one is surprised to find granuloma telangiectaticum. Goldman and Preston (1953) claimed regression in 4 out of 6 lesions treated.

REFERENCE

GOLDMAN, L., and PRESTON, R. H. (1953) *Arch. Derm. Syph., Chicago*, **67**, 163.

Dr. C. D. Calnan: I have had personal experience of a lesion very like this one; after treatment with diathermy there was no further recurrence. I cannot offer any explanation for it.

I was always taught to call these lesions granuloma telangiectaticum; the pathogenesis was thought to be a minor trauma causing some breach in the skin and new blood vessels grew up beyond the level of the epidermis which could not epithelialize over it.

Dr. L. Forman: The late Dr. W. Freudenthal held that there was a definite clinical and histological distinction between pyogenic granuloma and granuloma telangiectaticum. The finger-like, red projection of the latter is very different from the flat or domed exudative or crusted appearance of a pyogenic granuloma. The lesion of granuloma telangiectaticum shows large dilated capillaries throughout, suggesting an abnormal vascular response and new growth of vessels. The present case also suggests a tendency to new growth of vessels.

Dr. F. Haber: I remember one case of pyogenic granuloma attaining the size of a big cherry within four weeks and subsiding within a month. The histology looked very alarming, suggesting angiosarcoma.

POSTSCRIPT.—Since this case was shown, Dr. R. J. Cairns has drawn my attention to an article by Sims *et al.* in which an identical tumour and multiple local recurrences were reported in a boy aged 12 years. Follicular lesions of irritation from adhesive plaster also occurred in this case. Their diagnosis was hæmangiopericytoma, which they state cannot be differentiated clinically from pyogenic granuloma but only by the histological findings. Dr. A. L. Taylor has examined sections from my boy and agrees that the histology is identical with that described by Sims and his colleagues from their case of hæmangiopericytoma.—C.E.

REFERENCE

SIMS, C. F., KIRSCH, N., and MACDONALD, R. G. (1948) *Arch. Derm. Syph., Chicago*, **58**, 194.

? Reticulosis.—J. S. PEGUM, M.D., M.R.C.P.

R. G., male aged 28. Wood machinist.

History.—Eight months ago small mark appeared on right cheek, which gradually increased in size. Three months ago the lesion commenced to discharge "clear water with a little yellow in it".

Past history.—Motor cycle accident two years ago, injuring the right hand and fracturing skull. The skin, he states, was not injured.

On examination (10.6.54).—Tumour 3 cm. diameter on right cheek, with a surface which is red, partly keratinized, partly raw; clear serous discharge.

Special investigations.—X-ray (6.5.54), chest and hands: The vessels are well seen, but the patient is fat. Nil abnormal detected. Mantoux, 6.5.54, 1/10,000 negative. 20.5.54, 1/1,000 positive. Swab: Film: A few degenerate leucocytes. An occasional Gram-positive bacillus. Culture: Profuse *Staphylococcus pyogenes*, insensitive to penicillin, sensitive to Aureomycin and streptomycin. Blood count (10.6.54): Hb 110%, 16·0 grams/100 ml., leucocytes 5,600. Biopsy (4.5.54): Granulomatous infiltration in dermis, composed of masses of epithelioid cells, together with lymphocytes, the latter being mainly peripheral. Occasional giant cell. Examination with polarized light negative. Mycological examination of serum from discharge negative. Culture (3.6.54): Negative.

Comment.–The clinical appearance in this case originally was that of a granuloma compatible with a diagnosis of sarcoid. The histology also seemed to confirm this. However, the rate of growth since has been so rapid (it has almost doubled its size in the past week) that this seems unlikely. A diagnosis of cutaneous reticulosis is therefore more likely.

Dr. C. D. Calnan: I would suggest consideration of another diagnosis—chancroid pyoderma; the site is typical.

ADDENDUM (19·10·54).—The original tumour has almost disappeared following X-ray 500 r, at 97·5 kV, 2mm. Al filtration. Fresh tumours have appeared on scalp and penis. Appearances now suggest mycosis fungoides.—J. S. P.

Sarcoidosis with Involvement of the Central Nervous System.—R. G. HOWELL, M.R.C.P. (for G. B. MITCHELL-HEGGS, O.B.E., F.R.C.P.).

E. K., aged 24. U.S. Army Cook.

Fifteen months ago he burned the end of his nose with hot fat while cooking. The burn never completely healed and a chronic lesion remained. Ten months ago, glands in his neck began to swell.

On examination.—General condition good. No pyrexia.

Nose: Skin lesion: There is a red granulomatous lesion, 2 cm. diameter, with some central depressed scarring on the end of his nose.

Glands: There are bilateral enlarged firm discrete glands in the anterior and posterior triangles of the neck. A right supra-trochlear gland is also enlarged. Liver and spleen not palpable.

C.N.S.—Fundi: Gross swelling of the right optic disc without exudates or hæmorrhages. Right optic disc pale and nasal margin is indistinct. Visual acuity: Right 6/6; left 6/36. Pupils equal, reaction to accommodation. Plantar reflexes ↑ ↑. Right ankle- and right knee-jerk exaggerated. Abdominal reflexes present.

Visual fields: There are defects in the nasal side of the left eye field and temporal side of the right eye field, mostly in the lower quadrants.

Investigations.—Blood W.R. negative. Alkaline phosphatase 7 units. Thymol turbidity 3 units. Plasma proteins 6·8 grams: albumin 5·4 grams, globulin 1·4 grams per 100 ml. Mantoux 1/100 negative.

C.S.F.—Clear fluid. No cells seen. Pressure 90 mm. Protein 140 mg. per 100 ml., globulin slight increase. Colloidal gold 0000000000.

X-rays.—Chest: There is some increased shadowing in the left upper zone, the appearance of which resembles a tuberculous infiltration. Both hilar shadows are prominent and are probably partially glandular which favours the clinical diagnosis of sarcoid. Hands and feet: Possibly early cystic changes in right middle finger and left ring finger. Sinuses: Mucosal thickening of the right maxillary antrum. Skull: No abnormality seen.

Histology: Lesion on nose (Section): Small foci of giant and epithelioid cells with a few lymphocytes. *Gland of neck* (July 1953). Almost complete replacement of the normal architecture with round masses of pale epithelioid cells. No giant cells and no caseation.

Comment.—Sarcoidosis involving the central nervous system is uncommon. In this case, there may be a lesion involving the left optic tract from above and also spinal deposits involving the pyramidal tracts. The possible co-existence of tuberculosis of the lung is of interest. The only skin lesion has appeared at a site of previous trauma.

POSTSCRIPT.—This patient's weight increased while he was treated with cortisone; at the same time there was a regression of the physical signs.

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JEFFERSON, M. (1952) *Brit. med. J.*, ii, 916.

Dr. G. H. Ritterman: I showed a similar case with a nasal lesion at the 1952 International Congress. We were about to take a biopsy when the patient was injured on the right arm, an identical lesion developed and proved to be sarcoid. Unfortunately we lost sight of the case.

REFERENCE

RITTERMAN, G. H. (1953) *Int. derm. Congr., London*, p. 451, Case No. 41.

Dr. L. Forman: Is there any inverse relationship between the involvement of the skin and the central nervous system in sarcoidosis? We see so often considerable skin infiltrations without any clinical evidence of central nervous disease. In this case there are few deposits in the skin but considerable changes in the central nervous system.

Dr. Earl Moore showed me a patient in the Johns Hopkins Hospital, Baltimore—a young woman with a few small lesions of sarcoid in the skin. She had put on an enormous amount of weight. After cortisone she regained her normal size. It was thought that she had deposits of sarcoid in the thalamic centre controlling appetite and weight. Perhaps Dr. Howell could tell us if it is the meninges or the actual brain substance that is infiltrated with the granuloma.

Dr. R. G. Howell: It appears that the actual brain substance is involved. From the point of view of your patient putting on weight this patient says his weight has increased considerably. It will be interesting to see if cortisone affects that.

Dr. H. R. Vickers: In support of Dr. Forman's thesis we have a patient who has a small lesion on his nose and there are changes in the central nervous system very similar to disseminated sclerosis. If one saw him without the sarcoid on the nose one would have thought of disseminated sclerosis.

Dr. I. S. Hodgson-Jones: I showed a case here (1952) which had sarcoidosis of the skin, had the central nervous system also affected and which in some ways resembled this case. The picture was that of general paralysis of the insane and at one time even a weakly positive Wassermann reaction was obtained in the cerebrospinal fluid. Much antisyphilitic treatment was given and more recently cortisone and other things without alteration in the condition.

REFERENCE: HODGSON-JONES, I. S. (1952) *Proc. R. Soc. Med.*, **45**, 103.

Dr. J. E. M. Wigley: Why was it not G.P.I. with the positive Wassermann reaction?

Dr. I. S. Hodgson-Jones: Because his cerebrospinal fluid changes did not respond to antisyphilitic treatment which I understand from the venereologist would in the case of general paralysis of the insane be most unusual.

Dr. J. E. M. Wigley: I think that is an unconvincing reason.

The following cases were also shown:

Lichen Planus Annularis Atrophicus.—Dr. R. T. BRAIN.

Nodular Vasculitis.—Dr. J. E. M. WIGLEY and Dr. G. A. BECK.

(1) Cicatrizing Rodent Ulcer. (2) Sarcoidosis, with Lichenoid Lesions.—Dr. BRIAN RUSSELL.

Small-nodular Disseminated Sarcoid, Localized in Light-exposed Areas.—Dr. THERESA KINDLER.

(1) ? Mast-cell Reticulosis.[1] **(2) Purpuric Drug Eruption Due to Sedormid.**—Dr. M. FEIWEL.

(1) Chronic Ulcerative Pyoderma. (2) Case for Diagnosis. ? Granuloma Annulare. Dr P. D. SAMMAN.

[1] It is hoped to publish this case *in extenso* in the *British Journal of Dermatology*.

JOINT MEETING No. 5:

Section of Comparative Medicine with Section of Epidemiology and Preventive Medicine

[*February* 17, 1954]

DISCUSSION: GASTRO-ENTERITIS: THE ÆTIOLOGICAL IMPORTANCE OF VIRUSES AND *BACTERIUM COLI* (*Continued* from November *Proceedings*, p. 970)

Dr. Irving Gordon (From the Division of Laboratories and Research, New York State Department of Health, Albany and the Department of Medicine, Albany Medical College):

Human Virus Studies

Until the incitants of infectious non-bacterial gastro-enteritis have been cultivated in tissue culture or experimental animals, proof that they are viruses will be impossible. So far they have been investigated only in connexion with overt disease in human beings. The presumption that acute infectious non-bacterial gastro-enteritis is due to several different viruses is sound, however, having been fortified by the results of experiments performed with the aid of human volunteers. Since the end-point of all human volunteer experiments is presence or absence of clinical illness, we must define the various clinical syndromes before attempting an appreciation of the experimental results.

For the most part, the clinical reaction of the gastro-intestinal tract to infection is expressed by a stereotyped group of symptoms and signs impartially evoked by a number of different organisms. Anorexia, nausea, and vomiting; abdominal pain and diarrhœa; and constitutional manifestations, such as fever, malaise, headache, and vertigo, occur in combinations that can depend as much on the severity as on the specific incitant of the gastro-intestinal infection. When outbreaks occur, and enough cases are seen together, variations in response fall into patterns, the clinical types can be distinguished; but we may not impute clinical differences to different ætiologies without additional evidence.

The first step is to exclude known enteric pathogens by conventional laboratory examinations. "Virus gastro-enteritis" is the remainder, after illnesses due to known pathogens have been subtracted from the total of all acute gastro-enteritis. The remainder is surprisingly large. Outbreaks are seen repeatedly in all parts of the world, and the careful studies of Dingle and his colleagues (1953) have shown non-bacterial gastro-enteritis to be second in frequency only to acute respiratory infection as a cause of illness in families. Our present knowledge of virus gastro-enteritis is like that of the acute respiratory syndromes before the isolation of influenza virus led the way toward precise ætiological diagnosis. Clinicians of twenty years ago recognized influenza but realized that they often confused it with other respiratory diseases evinced by the same syndrome; and they were totally unable to distinguish between influenza A and B. To-day we know of several clinical types of non-bacterial gastro-enteritis, but the cumbersome method of human volunteer investigation so drastically circumscribes our ability to detect and compare agents from different outbreaks that we have made only a beginning toward framing an ætiological outline. No matter how many facts we learn about a given strain by human volunteer experiments, we are obliged to base generalizations on the quicksands of clinical and epidemiological resemblances, and the generalizations do not necessarily apply to strains causing other epidemics. Even the experiments depend, as was mentioned, on clinical yardsticks for end-points.

Under the circumstances we must take care not to be too nice in drawing clinical distinctions. At present we should focus on differences in two cardinal signs: diarrhœa and fever. With these criteria we can separate three types. There is an afebrile type with characteristic watery diarrhœa. We originally called it "epidemic gastro-enteritis" (Gordon, Ingraham, and Korns, 1947); later the term "afebrile infectious non-bacterial gastro-enteritis" was proposed (Jordan, Gordon, and Dorrance, 1953). A second type, in which patients likewise exhibit little or no fever, is characterized by upper gastro-intestinal symptoms without diarrhœa and has long been called "epidemic nausea and vomiting" (Miller and Raven, 1936). The "winter vomiting disease" (Goodall, 1954) is probably the same. A third type, characterized by fever and gastro-intestinal upset, was recently recognized in the studies of Cleveland families done by Dingle and his colleagues. There is no diarrhœa but constitutional symptoms are prominent. It has been tentatively named "febrile infectious non-bacterial gastro-enteritis" (Jordan *et al.*, 1953).

Here we are faced with the difficulty stated in the preamble. Experiments to compare "epidemic gastro-enteritis" and "epidemic nausea and vomiting" have not been done. We may not infer from presence or absence of diarrhœa that the two types are due to different agents; the distinction is solely clinical and epidemiological. In contrast, the afebrile diarrhœal type and the febrile non-diarrhœal type have been distinguished through human volunteer experiments (Jordan *et al.*, 1953) and there seems to be little doubt that they are due to different infectious organisms, probably two or more different viruses.

The first type studied in volunteers was afebrile diarrhœa. This is perhaps the most common. Our original strain came from an outbreak at the Marcy State Hospital, near Utica, New York, where approximately 20% of 2,600 mental patients developed the disease during an outbreak in December 1946. Spread seemed to be by contact. There was a rapid, often abrupt, onset with anorexia, nausea, vomiting, profuse watery diarrhœa, abdominal cramps, and mild constitutional symptoms, such as headache or vertigo. These symptoms or signs occurred in various combinations. Fever was infrequent, seemed to be related to the degree of dehydration, and was relatively low. Respiratory symptoms and signs were absent. Except in a few patients, in whom the diarrhœa fatally complicated pre-existing serious illness, those afflicted recovered spontaneously in a few days. This epidemic is typical of afebrile non-bacterial gastro-enteritis.

No infectious agent could be recovered by inoculation of a variety of experimental animals or tissue cultures. In the course of several years, however, the disease was serially transmitted from one

group of volunteers to another through seven consecutive passages by ingestion of bacteria-free fæcal suspensions (Gordon, 1954). Three of the seven transfers were done with inocula that had been passed through ultrafilters, the rest with fæcal supernates. Volunteers who swallowed or inhaled throat washings collected during acute naturally acquired or experimental illness remained well.

These experiments established that the Marcy strain was a filtrable infectious agent present in the fæces of patients and that the disease could be easily transferred by the oral but not by the respiratory routes. It was mentioned that respiratory symptoms and signs were not observed in the Marcy outbreak, and they were conspicuously absent in volunteer subjects with gastro-enteritis. Blood, urine, and spinal fluid were normal (Gordon *et al.*, 1953).

There was a direct relationship between attack rate and dose. Of a total of 96 volunteers fed various doses of active inocula, 66 came down with obvious gastro-enteritis. When a higher attack rate was desired, for example in immunity experiments, over 90% could be infected. Incubation periods in volunteers ranged between 1·5 and 5 days, averaging 60 hours. These data conform to those deduced from epidemiological analyses.

None of the volunteers, who were healthy young male adults, had suffered gastro-enteritis in the year or two prior to their participation, so in this respect, as in others, they were a select group. The 90% attack-rate argues, however, that there must have been relatively little pre-existing immunity due to prior subclinical infection.

A specific active immunity did develop within two weeks after an experimentally-induced illness. Of 17 men reinoculated with potent Marcy fæcal supernate, none experienced a second attack. Studies recently completed with the Marcy strain on other volunteers indicate that immunity to reinoculation may last for as long as a year (Gordon, Patterson, and Whitney, to be published). Diarrhœal non-bacterial gastro-enteritis recurs yearly in some families and communities (Dingle, 1953); therefore successive bouts may be due to antigenically different variants.

The febrile type of non-bacterial gastro-enteritis differs clinically from the afebrile type in the following respects: Fever is common, diarrhœa uncommon, as was mentioned; constitutional symptoms are more pronounced; and abdominal pain is more severe and constant. While no experiments with ultra-filtered inocula have been done, the syndrome has been reproduced through three successive transfers in volunteers by oral inoculation of bacteria-free fæcal supernates of a strain of the febrile type (FS), and it is presumed that the FS agent, too, is a virus (Jordan *et al.*, 1953). The incubation periods of experimental illnesses are definitely shorter than those associated with Marcy infections of volunteer subjects; they average 27 hours in FS disease, compared with 60 hours in attacks due to the Marcy strain. Reinoculation experiments showed convincingly that men recovered from Marcy illness were susceptible to a subsequent attack of FS gastro-enteritis, and the converse was also true. Like the afebrile type, the febrile type exhibits no respiratory component in experimental cases; and volunteers given throat washings from patients with induced FS illness remained well.

The studies with the Marcy and FS strains are not the only volunteer investigations. Japanese workers have transmitted other afebrile diarrhœa strains to volunteers and have confirmed and extended our findings with the Marcy strain (Kojima *et al.*, 1948; Yamamoto *et al.*, 1948). The Japanese strains and the Marcy strain have not been directly compared in active immunity experiments, but if this were possible, it would not be surprising to find them antigenically different. The studies made by Reimann, Price and Hodges (1945) in volunteers suggest that these investigators may have been dealing with still another agent, although dissimilarities in technique may account for some of the disparities between their results and those of the Japanese and ourselves.

Systematic exploration of the subject of non-bacterial gastro-enteritis awaits a competent method: but we are not foreclosed from applying what we already know. For example, we need only to make simple tallies of spread and adequate fæcal cultures to differentiate nursery diarrhœa of suckling children from "virus gastro-enteritis", which can affect persons of any age. In spite of the shortcomings of clinical investigation, further study of this group of diseases as they occur in humans will continue to disclose new and useful facts.

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Section of Orthopædics

President—H. L-C. Wood, M.S., F.R.C.S.

[*May* 18, 1954]

On the Clinical Significance of the Antalgic Position and Restriction of Motion in Cases of Low Back Pain and Sciatic Radiation

By A. Steindler, M.D.

Iowa City, Iowa

The timeworn and weatherbeaten subject of low back pain and sciatic radiation is likely to continue to engage our interest as long as it remains controversial.

Let me explain first why I choose the antalgic position and restriction of motion as the foundation for a diagnostic and therapeutic superstructure. The attribute "antalgic" presumes that there are certain positions which the patient is able to maintain and by which pain becomes attenuated or abolished. This leads to the conclusion that pain in low back disorders is not continuous and unchangeable but that it is controllable by positions and attitudes. In contrast, most back pain or sciatic radiation reflexly produced by extraspinal conditions is independent of position and the patient is unable to find comfort in any attitude. The special reasons for approaching the subject from the angle of the antalgic position are as follows:

First, the antalgic position including the leg signs is the most constant of all objective signs. Second, it is involuntary and is automatic. Third, it cannot be simulated by the patient. Fourth, it disappears after the cause of the pain, such as a herniated disc, is removed.

The objective is to correlate the antalgic position and restriction of motion with definite pathological changes. The first step toward this goal is to identify the structures which are under mechanical stress; the next is to show what pathological changes occur when these structures are under stress; and the third what role the movements of the body and of the extremities play in producing such stresses. From the clinical point of view it is customary to distinguish between the pain symptoms involving the lower back or the lumbosacral junction and those which present themselves as radiations due to pressure upon the roots of the sciatic nerve. From the pathological viewpoint this distinction can be challenged on the grounds that the two conditions are interrelated.

It may be questioned whether the pain in the low back is indigenous to the extraspinal structures of the low back, i.e. the muscles, tendons, ligaments and fasciæ, or whether, as some would have it, it is reflected from a protruding disc into the territory of the tissues which cover the lower back. We have the anatomical findings of Roofe and others which show the extreme scarcity of sensory fibres in the disc itself; we also know that all these structures receive their sensory supply from the posterior primary division of the spinal nerves, while the sciatic plexus is formed entirely by the anterior primary division which has no peripheral connexions with the rest. This makes this concept of a discogenic pain quite improbable.

But definite proof that the posterior back structures are the actual and direct pain producers in low back pain can be furnished by the Novocain test, which I have used since 1935 to localize the source of pain. The one requirement for this test is that there be a distinct spot painful to palpation, a so-called "trigger point." If the location of pain is thus determined, its origin can be proved by the pain and its reflex radiation being temporarily abolished by the action of the Novocain, after being aggravated by contact with the needle.

If the pain is indigenous to the local structures, the test will suppress local pain and nothing else. If the local pain-producing structure serves as the afferent branch of a reflex arc, then the Novocain will temporarily suppress the radiation as well as the local pain. Such cases constitute only a small minority but we have observed quite a number in which the injection of Novocain had this double

effect of abolishing both back pain and sciatica. Since the source of back pain lies entirely in the territory of the posterior primary division and the source of sciatica in the anterior, and since no anatomical connexion between the two divisions exists in the peripheral nerve system, the only explanation is that the sciatica is, in these cases, a reflex phenomenon. Finally, if the peripheral low back pain is referred from some other deeper lying structure not accessible to the Novocain infiltration, especially a prolapsed disc, then the Novocain injected into the posterior tissues of the back will suppress neither the local pain nor the radiation.

Various structures at the lumbosacral junction may be subjected to strain at different times. The supra- and interspinous ligaments and the ligamenta flava become unduly hypertrophic under the strain caused by instability of the lumbar junction; because of this the ligamenta flava have been unjustly accused of being responsible for the sciatic radiation.

Muscular strain of the sacrospinalis and quadratus, in particular of their periosteal attachments, may produce rupture of fibres which may include the gluteals and involve the lumbar fascia.

Strain of the intervertebral capsular apparatus involves all the capsular reinforcements as well as the pericapsular ligaments. It produces pain and tenderness at the sacrolumbar junction at or close to the mid-line.

There are strains of the sacro-iliac ligamentous masses and the sacro-iliac articulations in which tenderness and a sharply defined pain area is located at the sacro-iliac junction. Here the pain can be produced by a twisting movement of the pelvis.

On excessive forward flexion of *the trunk* the strain occurs first in the ilio-lumbar ligament, is then transmitted to the interspinous ligament from the 5th interspace up, and then to the lumbar fascia especially in the sacral triangle.

In backward bending, the sequence is reversed: the articulations are under strain first, then come the interspinous ligaments, while the ligamenta flava escape impingement.

On the other hand, on rotation, the ilio-lumbar ligament becomes strained first, then the quadratus lumborum, and then the intertransverse ligament. In side bending, the sequence is quadratus, ligamenta flava, and interspinous ligament.

The effect of *leg movements* lies principally in the movement which they impart to the pelvis. Single leg raising usually does not disturb the position of the pelvis; it does not force the pelvis into a backward rotation as long as it is not excessive. On the other hand, double leg raising will tilt the pelvis backward and produce definite pain response. In this case, the centre of rotation is the tuber ischii. When the knee is flexed, the tension on the hamstrings is relaxed and no pelvic tilt occurs.

So far as the sacro-iliac articulation is concerned, Patrick's sign in which flexion of the hip is combined in outward rotation and abduction strains the sacro-iliac joint only indirectly. In the Gaenslen sign the hyperextended hip rotates the os ilii forward on the sacrum, thereby producing a direct effect on the sacro-iliac articulation. The most revealing sign in sacro-iliac strain is lateral compression of the pelvis.

The antalgic position in lumbosacral strain may be defined as the reverse of the one by which the strain was produced.

The position of the *trunk in standing* may be symmetrical or asymmetrical. When a symmetrical forward bent position is maintained, it may be assumed that the injury is in or close to the mid-line at the sacrolumbar junction.

In the acute stage, the sacrospinalis is tense and one can elicit at this junction a definite trigger point. When the patient's body is forced backward in hyperextension, the point tenderness becomes accentuated because of the impingement of soft tissue. When he bends forward, he complains of a "pulling" sensation mostly located at the sacral triangle which is the area of insertion for the sacrospinalis. In the normal stance there is an angle of about 175 degrees between L.4 and L.5. On the other hand, when sitting at a right angle the hamstrings rotate the pelvis backward, especially if the knees are extended, and the lumbosacral curve is obliterated.

The antalgic position is still more revealing if the posture is asymmetrical; the tilt is either seen in upright position or it appears as the patient bends forward (Fig. 1).

A point of differentiation is this: if the strain involves only the structure of the lower back, the patient holds his knee straight whether bending forward, backward or sideways. Bending to the opposite side, he often complains of pain which arises from the homolateral lumbodorsal fascia and the insertion of the sacrospinalis muscle in the sacral triangle. At this spot a definite trigger point can be established. Injection of Novocain into this point causes the lumbosacral pain to disappear as well as the leg signs so far as they produce a backward tilt of the pelvis. The antalgic position itself may not disappear at once, but even if it does it is almost certain to recur as soon as the Novocain action has subsided.

In the *recumbent position*, pain caused by twisting the pelvis against thorax or vice versa is not as marked in the mid-line sacrolumbar strain as it is in the lateral strain of fascia and muscle. In the latter case pain also appears as the pelvis is twisted forward and toward the opposite side. The

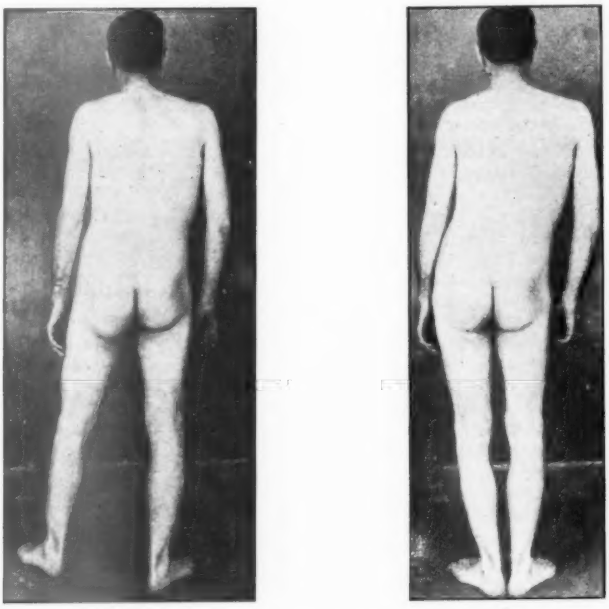
Ely and Brudzinski signs correspond to the forced flexion in standing and sitting; they become positive in very acute strain.

On the other hand, the single-leg-raising sign of Lasègue does not disturb the mid-line strain and lateral strain responds only mildly; the pain is always referred to the sacrolumbar junction. Double leg raising, however, tilts the pelvis backwards and it produces definite pain response.

The increased intraspinal pressure on a nerve root which results in sciatic radiation may be due to herniation of a disc, to a spinal tumour, or to direct pressure within a narrowed intervertebral foramen. It may, as has just been explained, also be the result of reflex action.

The most common causes and those in which we are primarily interested are the compression of the nerve in the intervertebral foramen and the posterior protrusion of the intervertebral disc. The latter was first reported by Oppenheim and Krause in 1909, and then by Goldthwaite in the United States in 1911. Calve and Gallant's report was preceded by that of Mixter and Barr who in 1922 called attention to unilateral leg pain as an outstanding symptom of a protruded disc.

The aperture of the normal foramen is about ¼ in. in diameter and it is oblong with a longer vertical and shorter horizontal diameter. The spinal nerve fills only part of the foramen and leaves ample space for blood vessel and areolar tissue.



1A 1B

FIG. 1.—Asymmetrical antalgic position. Sciatic scoliosis.

When the intervertebral disc becomes thinned out by degeneration, whether herniation occurs or not, the articular surfaces glide upon each other and the foramen becomes more narrow. This also increases the weight-bearing pressure upon the intervertebral articulation with a resulting osteo-arthritis which can invariably be seen in degeneration of the 4th and 5th lumbar discs.

Furthermore, as the disc collapses and the spinal facets glide on each other, the degenerative process produces spurs and ledges which may reach into, and encroach upon, the intervertebral foramen. At the same time the spinous processes contact each other. Williams speaks of the "kissing" spinous processes.

It is the merit of Sicard to have called attention to the encroachment of the intervertebral canals as a cause of sciatica, calling the syndrome "funiculitis", the funiculus being the portion from the confluence of the anterior and posterior roots to the exit of the common root from the intervertebral foramen. Putti in 1936 greatly elaborated this concept of "neurodocitis", as he called it, believing it to be the major cause of sciatic radiation. The canal for the 5th lumbar, and largest, root is especially narrow. Osteophytic spurs frequently narrow the lumen, and free cartilaginous bodies may even be found in it (Leubner, Logroscino).

Posterior Herniation of the Disc

The root leaves the dural sac somewhat above the respective disc and then swings in an arc toward the intervertebral foramen. At this level the next lower root has already perforated the dura and it lies medially to the upper. Consequently, only two roots can be seen outside of the dura at any level, namely, the one which runs through the intervertebral foramen at that level and the other, medial one, which runs to the lower foramen. Regarding the relation of this root extradurally to the prolapse of the intervertebral disc there are several possibilities (Armstrong). The disc may be medial or in the mid-line, in which case the pressure is more likely to be on the lower root; or a central disc may be pressing on the nerves of both sides; or the disc may lie between the upper and lower roots and in certain positions it glides over it; or the disc may be more lateral and closer to the foramen (as is more often the case) and then the pressure is upon the upper root. Armstrong points out that a large dissecting protrusion may extend upward and downward directly or by adhesion may become attached to the root of its level as well as to the upper or lower root; or, finally, a double protrusion may exist.

When the patient bends forward the intervertebral spaces open posteriorly an average of 2 to 4 mm. per disc, a total of 12 mm. There is a strain on the posterior longitudinal ligament. Backward extension opens the intervertebral space anteriorly and puts the anterior longitudinal ligament on tension.

In upright standing the posterior dura is relaxed and when it lengthens on flexion the slack is easily taken up. The anterior dura, on the other hand, is held in position by the extrathecal course of the root. Lying closer to the axis of movement, it lengthens only 5 mm., according to Armstrong. In side bending, however, a relaxation of the root occurs on the side of bending and the dura at the same time is pulled slightly to the side of convexity.

The effect of *leg movements* on the spinal roots is as follows: The leg signs in general are caused by stretching of the nerves of the cauda equina (O'Connell, 1951), whatever the position of the disc.

Straight leg raising produces an increased tension of the 4th and 5th lumbar and of the 1st sacral roots. According to Inman, this movement amounts to 2 to 5 mm. for each root. However, up to an angle of 30 degrees to 40 degrees the normal root not pressed by a herniated disc remains stationary. Numerous observers have found that elevation of the leg had this stretching effect upon the nerve; in fact, it has been shown by Woodhall and Hayes (1950) that when one leg is raised, the lower lumbar roots on the opposite side emerge a little from the spinal canal. The 5th lumbar and the 1st sacral are most affected. However, the principal point is that the sciatic trunk is fixed by the external popliteal nerve as it winds around the fibula.

The anatalgic position is here represented as it occurs in sciatic radiation irrespective of whether the latter is caused by a disc or by a foraminal encroachment. In both conditions homo-, hetero-lateral or alternating scolioses are observed. Walsh, Rambout and Petit state as a point in differential diagnosis that arthritic manifestations are as a rule more extensive, involving several vertebræ. If it is localized it is difficult to account for it other than as a secondary effect of disc degeneration with subsequent impaction of the articular processes leading to foraminal encroachment. A negative myelogram in the face of persistent sciatic radiation is also in favour of foraminal encroachment. The response to conservative treatment applies to both conditions.

Antalgic Posture

The usual antalgic standing position in either protruded disc or foraminal encroachment is a slight forward flexion and an inclination to the sound side. When the extrusion of the disc occurs, the lumbar spine becomes fixed in a forward bent position since the disc remains wedged and cannot recede. It will be noted, however, that the patient also anxiously maintains a definite degree of forward flexion. To bend forward more, for instance by forcing the shoulders forward, would put a stress upon the posterior longitudinal ligament and other soft structures. The antalgic position is fixed both against forward and backward bending. Any attempt at backward bending causes nerve root pain by pressure upon the disc. If pain is produced on backward bending as the shoulders are forced backward by the examiner, it indicates that the disc is protruded without rupture of the posterior longitudinal ligament. This backward bending makes the disc protrude more, while forward bending promptly relieves it.

In asymmetrical forward bending, that is, in sciatic scoliosis, the list to the side is also fixed to a certain range although not as rigidly as the forward bent position. The patient can increase the list without pain but he cannot reverse it. One usually speaks of a sciatic scoliosis although this is a misnomer. It is not a scoliosis because the essential element of rotation is missing.

The list is sometimes homolateral but more often is contralateral (Fig. 2). It is explained by Armstrong that this difference reflects the topographic relation between root and protruded disc. If the protrusion is medial to the root or paracaudal, a relief of tension is obtained by homolateral tilt which causes a contralateral scoliosis (Figs. 3 and 4).

However, if the protrusion is lateral to the root or pararadicular, which is the usual case, then a contralateral tilt or homolateral scoliosis is produced.

The so-called alternating scoliosis is explained by the root slipping from one to the other position relative to the disc. The nerve rides on the summit of the protrusion (O'Connell, 1951). The alternating scoliosis is a phenomenon peculiar to the disc alone and it is not found in the foraminal compression where the tilt is usually contralateral to improve the patency of the foramen.

One might object that a list to the opposite side puts a stress on the spinal roots. For one thing one must consider that a homolateral list, by throwing the line of gravity toward the affected side, causes the abductors and outward rotators to contract strongly, to which the sensitive sciatic trunk may be intolerant. Still, this would not eliminate the fact of passive tension being applied to the nerve roots when the tilt is contralateral. What one should take into consideration more than the tension on the root exerted by the tilt is the fact that the patient holds knee and hip of the affected side in flexion (Fig. 5).

This flexion position appears not only in forward and backward but also in side bending. The explanation is that flexion of the knee is essential for the relaxation of the sciatic nerve. One can convince oneself easily in the dissecting room that when the knee is extended a strong pull is exerted on the sciatic nerve which is fixed tightly by the external peroneal winding around the neck of the fibula. On the other hand, the flexion of the hip-joint alone exerts only a very moderate pull.

In recumbency the equivalent of antalgic posture is the restriction of movement of leg against the pelvis, as it is manifested by the so-called leg signs. The most important and most constant of these is the straight-leg-raising sign of Lasègue. It calls for flexion of the hip and extension of the knee at the same time and thereby forces a position just opposite to the relief posture in standing when

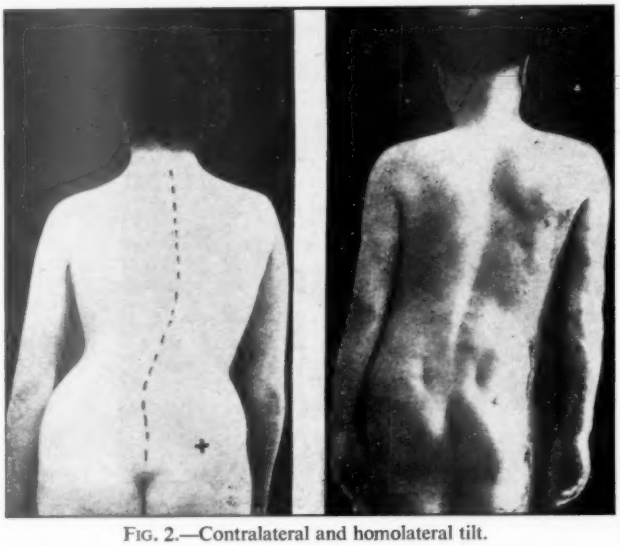


FIG. 2.—Contralateral and homolateral tilt.

hip and knee are flexed. The extension of the knee exerts a powerful pull on the sciatic root and one can, in fact, gauge any improvement obtained by the amount of straight leg raising a patient is able to do. This sign is hardly ever missing during the sciatic attack. O'Connell in his Hunterian Lecture (1951) stated its frequency at 99%.

Of special interest is the contralateral-leg-raising sign of Fajersztajn (1901). It consists in a sciatic radiation when the opposite leg is raised. One may explain it by the fact that when the sound leg is elevated the gluteus maximus on the affected side as well as the outward rotators contract to prevent the pelvis from being backward rotated by the elevated sound limb. The thigh of the affected side is held firmly to the table in full extension and outward rotation. It may well be that this tension of the hip muscles exerts pressure on the sensitive sciatic nerve and the patient complains of sciatic radiation. It may also be that when the well leg is flexed in the hip with the knee extended a pull is exerted on the dural sac through the sciatic plexus which causes the sac to deviate toward the well side, thereby producing a strain on the roots of the affected side. The roots are seen to emerge slightly out of the intervertebral foramen into the spinal canal. Woodhall and Hayes (1950) found

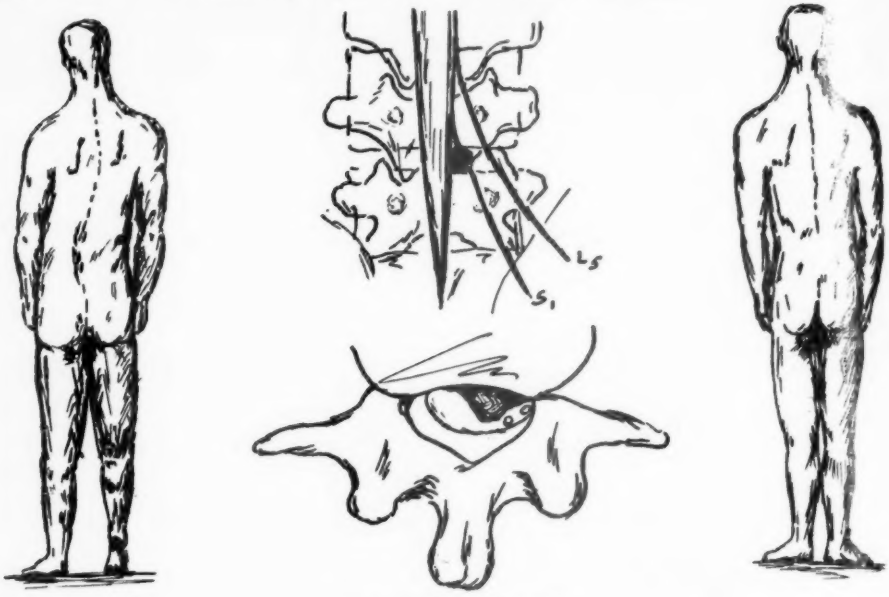


FIG. 3.—Disc medial to root.

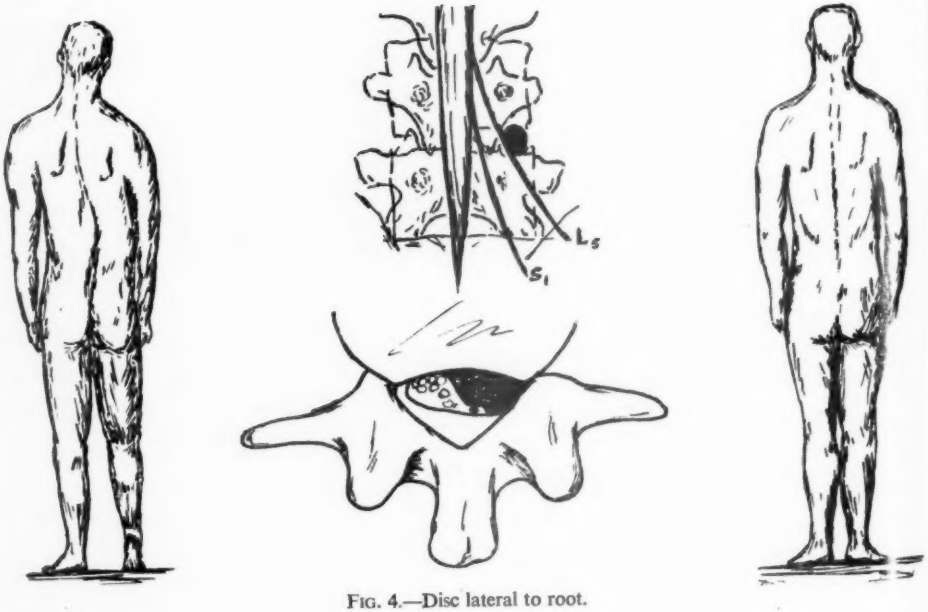


FIG. 4.—Disc lateral to root.

the well-leg-raising sign positive in 95 operated causes among a total of over 300. In these patients the protrusion was never lateral to the root but beneath or medial to it. At the 5th lumbar interspace the protrusion may lie beneath the 1st sacral root or between this root and the sacral sac. Of all their patients, Woodhall and Hayes found this well-leg-raising sign positive in almost one-third of the patients with verified disc protrusion. They explain that as sound side flexion of the hip with knee extended causes the contralateral root of L.4, L.5 and S.1 to move proximally, they are at the same time being crowded against the anterior wall of the spinal canal.

It can be stated in general that in the absence of a fixed flexion position of the trunk and of the straight-leg-raising sign, it is unlikely that a disc protrusion either exists or, if it does, that it exerts at the time any pressure upon the roots of the lumbosacral area.

Intermissions and remissions of the attacks of sciatic radiation are common occurrences in cases where clinical examination has established a protrusion of the intervertebral disc. This opens the question whether compression of the spinal root by a protruded disc is a stationary and unchanging event or whether it is reversible. If it is reversible, what factors determine the reversibility? Clearly it is upon this point that the entire conservative treatment must rest. By the same token, we see also remissions of well-established low back pain occur not only in simple low back cases but even more

FIG. 5.—Tension on sciatic nerve relieved by flexion of hip and knee.

frequently in cases which complain of both low back pain and sciatic radiation. The recuperative power of strained ligamentous and muscular structures can be assessed by analogy with other locations. It is well established by our experience in the supporting ligaments of the large joints, especially knee and ankle, under what conditions and to what degree natural recovery can be expected.

One must ask oneself what the degeneration of the disc which produced the posterior prolapse has to do with the instability of the lumbosacral junction. Most likely the common cause for both lies in the degeneration of the disc. Certainly, the disc must have its share in the lumbosacral stability since it is the principal structure upon which the intrinsic equilibrium of the spine depends.

Schmorl and Junghanns emphasize that neither the prolapse nor the foraminal encroachment nor the exostosis which forms the posterior wall of the foramen should be taken separately, but that they are all factors of one pathological unit and they are all closely related. So it happens that the cause of the sciatic pain in one case is less due to the protrusion than it is to foraminal obstruction; in another case it is associated with the relaxation of the posterior ligamentous structures at the lumbosacral junction.

What natural course does the degenerated and fissured disc tissue take? It has been shown that these discs heal by a fibrous scar, but this may not occur until after the posterior epidural protrusion

has taken place. Experiments on rabbits (Smith and Walmsley, 1951) have shown that after the disc had been incised, the annulus depended for healing on the vascular supply of paravertebral tissue. Failure of healing is associated with avascularity of the deeper annular fibres. If the strength of the lamellæ has been reduced by degeneration, the deep fibre may rupture and allow the nucleus to prolapse. Repeated injuries cause additional fibres to give way, with further prolapse. Only with definite healing by fibrous scar is a halt set to the progressive protrusion.

Nucleography may furnish some information of the state of degenerative changes. Erlacher (1952) has described several forms recognizable by this method.

The globular nucleus is healthy, seen mostly in the young. A lobular nucleus is seen in adults and in large lobulations protrusion is unlikely. A simple branched nucleus with a central shadow and a few long and narrow branches is predisposed to herniation. A multiple branched nucleus with a small central shadow makes prolapse likely; and, finally, a spread nucleus with no central core and many branches running in all directions represents a fully degenerated, thinned, scarred disc which is no longer expected to herniate.

The normal disc is a viscous, elastic structure which is capable of sustaining considerable compression without losing its shape. Virgin (1951) specifies that in this elastic rebound the ability of the disc to take up fluid is as important as is the removal of the deforming force. When pathological changes appear which interfere with this adsorption, it is easy to see that the breaking point of the fibres of the annulus is considerably lowered.

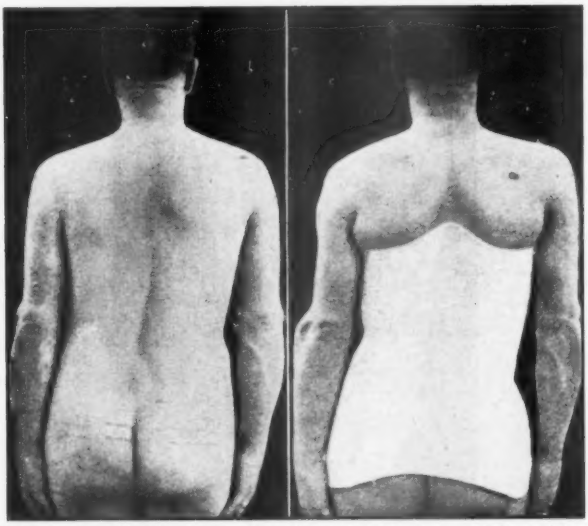


FIG. 6.—Putti's cast application without forcibly correcting the antalgic position ("as is").

The question whether all protruded discs call for operative removal or whether a course of conservative treatment should first be tried is answered by these possibilities of spontaneous arrest. Not even the encroachment of the foramina by exostoses demonstrable in the X-ray picture necessarily calls for surgical intervention because, as has been shown by Burns and Young, the nerve root may actually dig its way into the foraminal wall and become lodged in an excavation of it. As a rule, however, there remains ample space for the passage of the nerve.

There are other factors responsible for the episodicity of sciatica, both in point of remission and exacerbation. One is the actual size of the protrusion. This is increased by œdema and as the swelling decreases it may cease to bring pressure upon the spinal roots. A. Naylor at the meeting of the British Orthopædic Association in 1952 called attention to the increase of water content of the nucleus pulposus as a factor in the development of low back pain and sciatic radiation. His experiments showed that discs immersed in water attain their maximum swelling in fifteen hours, and he believes that when the annulus is degenerated, increase in water content might precipitate herniation.

Remissions may also be caused by the disc slipping in and out from between the intervertebral space and thereby periodically causing relief of pain. This is possible in the earlier stages where the root is still comparatively movable, while in the later stages adhesions cause the root to maintain a more

stationary position. Exacerbations, on the other hand, may be due to impaction of the nuclear fragment. The size of the protrusion also varies with movement and pressure and therefore may suddenly become increased by exertion or brisk motion; a hitherto free nerve root may become adherent; or a tear in the disc becomes suddenly enlarged to allow a greater degree of prolapse.

Therapeutic Conclusions

The existence of antalgic positions in low back pain and sciatica, of course, is not in itself proof that spontaneous recovery without surgical interference is to be expected. The fact is, rather, that these positions signify a state of truce in which the irritating factor producing ligamentous strain or root pressure has been suspended temporarily. But reports on clinical observations are accumulating which indicate reversibility in the relation of the disc to the spinal roots and the recoverability of the ligamentous and muscular structures which are responsible for low back strain. These reports are strengthened by pathological findings of a natural disc repair. The observations also indicate that this process of healing is facilitated by a treatment of rest which often permits the œdematous disc to shrink to a quarter of its original size. The logical inference, therefore, is that a reasonable trial of conservative treatment should be instituted in all cases.

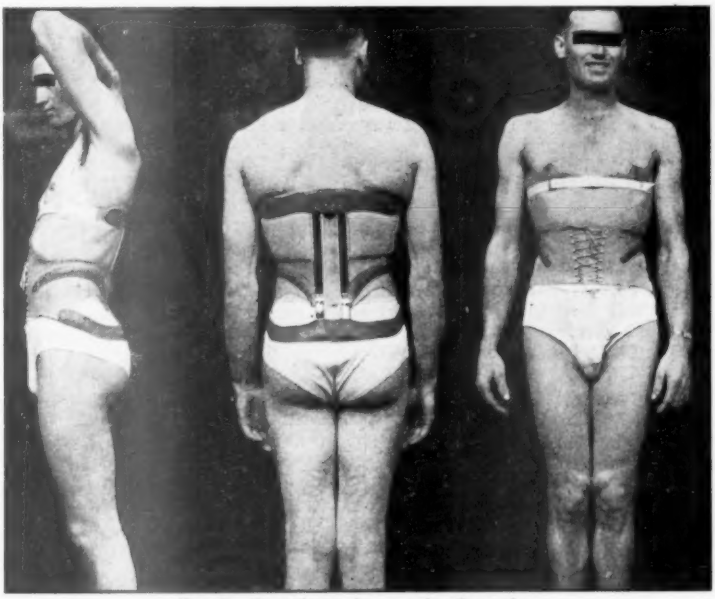


Fig. 7.—Back brace for sacrolumbar spine.

Barr (1951) has lately voiced the opinion that 30% of patients with disc lesions will recover spontaneously from their first attack, and this figure is certainly not too high.

Wardle of Liverpool (1950) states that conservative treatment based on correction of deformity and retention of corrected position yielded success in 70% of 269 cases. Putti was accustomed to immobilize the spine in plaster without trying to correct the antalgic position (Fig. 6).

In the late stage the chances of firm ankylosis of the intervertebral joints are also better if the spine is immobilized. Therefore, it is only rational for success of conservative treatment to protect the disc from all strain and to prevent motion between the bodies of the vertebræ (Fig. 7).

Armstrong believes that only the patient with an early lesion will respond well to conservative treatment and that the outlook is worse for patients in whom the protrusion is old with adhesions already formed. Only 15% of O'Connell's cases (1951) were, however, operated on. Kerr (1950) orders absolute bed rest for three weeks before getting his patients ambulatory in a plaster jacket, and performs the operation only when conservative treatment has failed.

In our own series, only 20% of the patients complaining of low back pain and sciatica were subjected to laminectomy, and then only after a myelogram had been taken. In regard to the latter, I would say that we never failed to find a prolapsed disc if the myelogram had definitely showed it. There

were only 3% of the cases in which the myelogram was misleading, and in which the disc prolapse was present in spite of the fact that no abnormality could be demonstrated. In cases in which foraminal encroachment alone is responsible for the sciatica one would, of course, also expect a negative myelogram. However, these cases must be rather rare. Furthermore, foraminal encroachment is an arthritic condition not usually localized to one root and more readily susceptible to conservative treatment. We do not subject such cases to myelography since no operative procedure is planned.

It is interesting to us that our figures tally with the statistics of Armstrong who has had enormous experience in this field. According to him, only 10% to 20% of the cases have symptoms so severe as to make operation necessary. In 60% to 70% conservative treatment will alleviate the symptoms to a point where they become compatible with normal life provided some restriction is placed on the activity of the patient and provided he will put up with an occasional exacerbation of comparatively short duration.

The failure of conservative treatment, however, in established cases of sciatic radiation with a disc lesion confirmed by myelography fully justifies the operation. Various authors report between 60% and 86% of success under these circumstances (Nachlas, 1952; Eyre-Brook, 1952). All are agreed that an adequate trial of conservative treatment should precede the operation.

The antalgic position is presented here as a criterion of conduct in regard to both low back pain and sciatic radiation because it proves only that low back pain and sciatic radiation can be held under a certain control and not that it assures recovery. It is, at any rate, the best objective information we can obtain on the type and nature of the disorder. The periodic appearance and disappearance of such a position and restriction of motion do signify, however, that a degree of reversibility exists. They bespeak at least the possibility of natural repair and thereby profoundly influence the choice of treatment. In accord with most surgeons we do not hold with those who make the operative indication on the spot. This is an easy and convenient way out of a difficult situation only if one is willing to ignore the possibilities of natural repair.

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BOOK REVIEWS

A Practical Manual of Diseases of the Chest. By Maurice Davidson, M.A., M.D.Oxon., F.R.C.P. Lond., with the assistance of John H. Friend, M.D.Lond., M.R.C.P.Lond. 4th edition. (Pp. x+647. 84s.) London, New York and Toronto: Oxford University Press (Geoffrey Cumberlege). 1954.

In his preface to the first edition of this Practical Manual, the author began: "The last few years have witnessed a remarkable development in the diagnosis and treatment of disorders of the chest . . ." If this was the case in 1935, it is even more so to-day. Since the last edition of this book appeared in 1948, the active treatment of pulmonary tuberculosis has been almost transformed by improved knowledge of antibacterial drugs and the increased scope of surgical technique. Similar advances, although less spectacular, have been witnessed in other departments of chest medicine. This new knowledge has been incorporated in the present edition of this book with a necessary avoidance of too much detail. The subject matter has been arranged in conventional style with the first section devoted to preliminary considerations of anatomy, physiology, radiology and systematic examination. An important chapter has been inserted on the relation of chest disease to general medicine and pathology, a subject which is steadily increasing in significance as the tissue basis of the pathology of the Collagen group of disorders becomes more clearly defined. This chapter would respond to amplification. The author has, to a large extent, called upon his own personal experience to which the number of case reports bears testimony. The Manual can be regarded as one of the most comprehensive single-volume textbooks in the language. The production is good and the illustrations are, with few exceptions, excellent.

Emergency Treatment and Management. By Thos. Flint, Jr., M.D. (Pp. xii+303. 29s.) Philadelphia and London: W. B. Saunders Co. 1954.

This book was written primarily for general practitioners and hospital residents. It aims to provide a guide for the management of all types of emergency condition from the time of their first being seen to their disposal for definitive treatment. For rapid reference, the subjects are arranged in alphabetical order. The character of the different entries varies. Thus, under the heading of "Death Cases", brief practical instructions are given on how to determine that the individual is dead and what to do in cases of doubt. On the other hand, under "Abdominal Pain" there is a list of 68 conditions which may cause abdominal pain. The biggest list is under "Acute Poisoning" which extends to one hundred and fifteen pages, and constitutes a catalogue of the symptoms and treatment of almost every possible poisonous agent.

The book thus varies under its different entries from being a simple practical guide to an encyclopædic book of reference, and it is this uncertainty of intent which constitutes its weakness. The actual advice given is, in general, sound and very up to date.

There is a final chapter on administrative and medicolegal procedure which, being based on American experience, will not necessarily apply in this country.

Proceedings of the First World Conference on Medical Education. London 1953. (Pp. xvi+804. 1 plate. 60s.) London, New York and Toronto: Oxford University Press (Geoffrey Cumberlege). 1954.

In this well-edited and beautifully produced volume are collected together nearly a hundred addresses delivered at the First World Conference on Medical Education held in London in 1953 under the auspices of the World Medical Association and the presidency of Sir Lionel Whitby. After each address follows a brief summary of it in English, French and Spanish. Brief accounts of the discussions are also included but, in general, these add little to the value of the book.

Sir Richard Livingstone's address on "What is Education?" rises to a high philosophic level and should be read by all medical teachers.

The main portion of the book is divided into four sections dealing respectively with the requirements for entry into medical schools, the aims and content of the medical curriculum, techniques and methods of medical education, and preventive and social medicine. On reading the first section one notes that there is no certain way of choosing those who will become good doctors, for by every way of choosing there is a considerable wastage. Intelligence and aptitude tests do not seem to fulfil expectations. We were impressed by the plea put forward by Sir Charles Dodds for the integration of the teaching of chemistry under one administrative control, instead of its being taught piecemeal in several separate departments.

In the second section come some stimulating addresses. Melville Arnott adopts a very reasonable view of "The Aims of the Medical Curriculum", while Sir Henry Cohen's distilled wisdom on "The Balanced Curriculum" reads almost like an oration of Cicero. In this section appear the two most striking and original suggestions for co-ordination of teaching. S. Zuckerman and H. P. Gilding

Dr.

advocate the integration of the teaching of anatomy and physiology and the shortening of the time devoted to anatomy, while Oliver Cope recommends the teaching of medicine and surgery as one discipline. Both seem to promise well for the future.

Section three contains much useful advice on the subject of technique in teaching but it is likely that the ordinary reader will get most enjoyment and profit from the delightful address in the true Oslerian manner by Sir Geoffrey Jefferson on "Teaching Surgery at the Bedside". Of practical interest also is the dissertation on "Why Students Fail" by T. R. Henn.

The two hundred pages devoted to addresses on the teaching of Social and Preventive Medicine show how much this branch now occupies the attention of medical teachers. There are many excellent articles along orthodox lines but if any of the older school of thought wish to be stimulated we would recommend them to read the witty but very provocative address on "The Teaching of Nutrition" by H. M. Sinclair. The discussion on this paper produced some interesting views on the future of mankind.

This book contains something of interest for teachers in every branch of the medical curriculum and every medical library will need to have one or more copies on its shelves.

Psychophysiologic Medicine. By Eugene Ziskind, M.D. (Pp. 370. 52s. 6d.) London: Henry Kimpton. 1954.

This is a book for general practitioners and general physicians, and it is concerned with the production of bodily symptoms by emotional disturbance, without associated organic disease. It does not deal with mental illness in the usual sense except for one very clear chapter on differential diagnosis, and it does not deal with "psychosomatic medicine" except in one chapter where Dr. Ziskind examines very critically the claims sometimes made about it. The author is an eclectic psychiatrist though he gives a fair and adequate account of the more specialized schools. He has been accustomed to working with general physicians and he assumes intelligence and interest in his readers, so that while the book is remarkably free from obscurity and pedantry, it does not read like a child's primer, as such books so often do.

Dr. Ziskind takes as his premises "what is common to most psychiatric thinking, namely that the needs of human beings, when frustrated, result in personality conflicts; that the process of social adaptation is universal, but often unsuccessful; that early life conflicts endure; that persistent conflicts may crystallize into character patterns; that unresolved conflicts may be transmitted into symptoms of organic illness through the autonomic nervous system". He then discusses the basic principles of psychopathology, successfully transcending the internecine psychiatric squabbles which so often obscure simple issues and perplex the therapist. He describes the method of assessing a life-history and shows how diagnosis may stem from personality study. He ends the first half of the book by relating those practical measures which may be taken by the physician who is prepared to give the necessary time to the work. The system of psychotherapy outlined is the logical product of the premises already mentioned.

The second half of the book—Parts 3 and 4—are written for the information of the physician rather than to teach him what he may do for himself. Psychopathology is considered in more detail to show what the psychiatrist can reasonably hope to do, and what may be expected of him. The gulf between practical clinical psychiatry and the academic psychoanalytical schools seems less wide when Dr. Ziskind has spanned it. He very rightly says that "Adlerian concepts have not been given the recognition that their widespread usage and acceptance in psychotherapy and pedagogy would seem to warrant".

This book deserves to be widely read for its balance and wisdom, its fairness, and its unvarying clarity of exposition. One slight criticism may be ventured, in the form of a hope that in a future edition the chapter on child–parent relationships may be extended. In its present form it is excellent as far as it goes, but the account is shorter than its importance merits, and provides less than the pædiatrician will require.

The book is well produced and has an adequate index. A useful bibliography is given, taken principally from the American literature.

Bacteriology for Students of Dental Surgery. By R. B. Lucas and Ivor R. H. Kramer. (Pp. viii + 262; 56 illustrations. 22s. 6d.) London: J. & A. Churchill Ltd. 1954.

The principles and techniques of bacteriology and the characters of the more important pathogenic micro-organisms are here described on the same lines as in a textbook intended for medical students, but more briefly and simply. The numerous illustrations include histological sections as well as photographs of the bacteria causing them, and the text describes characteristic tissue reactions to infection. Relatively more space is naturally given to species (e.g. *Fusiformis*, *Actinomyces*) causing lesions which the dental surgeon may encounter. The chapter on streptococci is almost entirely about *Str. pyogenes*; a separate and detailed description of *Str. viridans* seems to be called for in view of the importance with which this organism (or group of organisms) is credited in oral pathology.

Another useful addition would be a description of the flora of the mouth, although admittedly most of the species are mentioned somewhere.

The two concluding chapters are purely dental, their subjects being the bacteriology of dental caries and periodontal disease, and the bacteriological examination of oral lesions ("oval" in the Table of Contents). It is unfortunate that the ætiology—so far as bacteria are concerned—of by far the commonest oral lesions, caries and pyorrhœa, is so imperfectly understood, and the authors cover this rather difficult ground in a judicious and non-committal manner.

The book is well written and attractively produced, and seems likely to serve its purpose well.

An Introduction to Physical Methods of Treatment in Psychiatry. By William Sargant, M.A., M.B., F.R.C.P., and Eliot Slater, M.A., M.D., F.R.C.P. 3rd edition. (Pp. xix+351. 20s.) Edinburgh and London: E. & S. Livingstone Ltd. 1954.

This book was one of the few fruits of the last war, and it crystallized the work of the authors and of many others in a way that had not been done in psychiatry before. It is now in its third edition and has been translated into Swedish, Spanish, German, and French; and it is a standard work of reference for most matters pertaining to physical treatment in psychiatry. The young psychiatrist feeling his way with insulin shock therapy or electroplexy will find here the clearest account of the technique of these procedures available in the English language.

The authors made their position clear in the first edition when they set out to seek coherence and simplicity even though this involved a "dogmatic strain" in the writing of the book. While this was a permissible view then, it is doubtful whether it is so now, when so well known a book is probably in the possession not only of most psychiatrists, but of most barristers as well. The difference between an expression of a firmly held opinion, and the enunciation of an incontrovertible truth is not always made clear, and references to "experience" occur frequently in the book in a context which makes it clear that this is to be equated with agreement with the authors. Insulin and electroplexy, in particular, were seen to arrive by most psychiatrists who are 40 years old or more, and a claim to extensive experience of these techniques could be made by many hundreds of people.

That insulin is more effective than E.C.T. when large series of cases of schizophrenia are studied, can be regarded as established. A little reflection will show that this is not the same thing as proving that in a single case insulin will be more effective than E.C.T., and most clinicians will remember with regret patients who deteriorated under insulin, and who might have been maintained effectively with electroplexy. In discussing leucotomy in the context of schizophrenia, it is stated that "in paranoid schizophrenia the results are more favourable still and may be spectacular, especially in paraphrenia . . ." a statement with which few would agree, as to its first part, while conceding the second part of the statement which is really quite a different proposition. Many, too, would feel that the usefulness of "maintenance" E.C.T. in the treatment of paraphrenics is underestimated.

At the most it might be suggested that the authors express their convictions a little more tentatively in respect of the matters just mentioned. There are two sections, however, which should be revised as opportunity serves. The recent work of Lewis and Fleming has not confirmed that constitutional tendencies are released by ACTH or cortisone, and it is now virtually certain that the danger of these substances from the psychiatric point of view, has been greatly exaggerated. The account of Antabuse quite misses the point of giving the substance at all. This depends upon the fact that it is slowly excreted over some days during which an alcohol-Antabuse reaction can be precipitated. Thus, in effect, the patient must give himself a week's notice before he can start to drink again, which is invaluable in treating the alcoholic whose relapses start with an overpowering gregarious impulse, or a fluctuation in mood. The expression "Fatalities will probably prove entirely avoidable in future, if due care is taken . . ." may well be a joy to barristers, but there is not a shred of evidence for it, and it should be deleted. Deaths have occurred without any clue as to what went wrong.

This is a small volume of criticism of a book which covers a vast amount of ground, and is composed of material which, of its very nature, is controversial. It remains the most stimulating and the best book available on the subject, and no psychiatrist other than one engaged wholly in psychotherapy can afford to be without it.

The quality of the paper has greatly improved since the last edition, and the book is pleasingly produced. The index is full and convenient. The chapter on Epilepsy by Dr. Denis Hill has been retained and expanded and is thoroughly up to date.

For what it offers the book is very reasonably priced at 20 shillings.

Mayo Clinic and Mayo Foundation. Collected Papers, 1953. Vol. XLV. (Pp. x+913. 63s.) Philadelphia and London: W. B. Saunders Co. 1954.

These annual volumes have by now a well-recognized character and place in medical literature. Though they contain much of interest to the physician and the pathologist, they are chiefly read by the practising surgeon. In these volumes the surgeon looks chiefly for evidence on how ideas have prospered when applied in standard fashion on a large scale by consummate craftsmen.

It is impossible to review in detail the many papers herewith collected. Points that interest the

present reviewer are the favourable verdict on vagotomy for recurrent peptic ulcer after gastric resection, and the evidence that all is not well with the surgery of the biliary ducts as shown by the frequency with which calculi are missed during cholecystectomy. Other points of interest are the pessimism on the cure of regional ileitis with both medical and surgical treatment; and *per contra* the favourable late results of sarcoidosis, irrespective of treatment. There is a judicial assessment of the relation of the thymus to myasthenia gravis.

This is a book for dipping into rather than for sustained reading, and each will dip according to his personal interests.

Textbook of Operative Gynæcology. By W. Shaw, M.A., M.D., F.R.C.S., F.R.C.O.G. (Pp. x + 444. £5) Edinburgh and London: E. & S. Livingstone Ltd. 1954.

This is a book of real quality and is an example of a surgical textbook published with due appreciation of all the necessary factors which go to make a good book. The great knowledge and experience of the author are very evident and are shown off to perfection by the excellent quality of the text, of the paper and of the illustrations in the book itself. The illustrations deserve special mention, for both the black and white drawings and the coloured prints are of the highest quality and show well all the points they are meant to illustrate.

The book is more than a description of technique. It contains a wealth of information about gynæcology in general and about the pre- and post-operative treatment as well as the details of anatomy and surgical technique. Wilfred Shaw is careful to give expression to the views of other authorities on practically every gynæcological condition about which there is any controversy. But he follows this up by indicating very clearly his own views on the matter. This leads one to perhaps one of the biggest criticisms of the book, namely, the amount of space that is devoted to subtotal hysterectomy, and the rather reluctant acceptance of total hysterectomy as the better operation. The author rather suggests that vaginal prolapse is a common happening after total hysterectomy (p. 63). He also emphasizes the occasional fact that complications such as fistula, hæmorrhage, sepsis, &c., do occur after total hysterectomy (p. 85). But he does not equally stress that all these complications are unusual and are rarely experienced by competent operators. It is true that Wilfred Shaw states in the book over and over again that total hysterectomy must be done if various complications are present or even suspected. But the general impression one receives from the chapters on hysterectomy is that Wilfred Shaw would still have condoned the fairly frequent performance of subtotal hysterectomy. In the reviewer's opinion this is to be regretted since it does not represent the general trend of modern British gynæcology in the hands of the most enlightened operators.

To return to the discussion of the remainder of this beautifully published book: it is sufficient to say that the earlier chapters give detailed description of pre-operative preparation, of the patient (in which perhaps some more stress might have been laid on urinary tract disinfection), on anæsthesia and on one of the author's pet subjects, pelvic anatomy. This follows a chapter describing the technique of opening and closing the abdomen. Another chapter on post-operative treatment contains many useful hints but the reviewer is sorry to see the advice to put the patient in the Fowler's position. He would also disagree with the statement that "post-operative vomiting is relatively rare at the present day with modern forms of anæsthesia".

In the chapter on myomectomy the indications are well described and the various mechanical means of checking hæmorrhage during the operation are discussed. No mention is made, however, of that very effective method, the injection of ergometrine or pitocin directly into the uterine muscle. This injection is, however, recommended *after* the operation of myomectomy.

One of the most interesting chapters in the book is that upon cancer of the cervix. A brief survey of the arguments for and against radiological treatment is given and the more extensive modern operations are mentioned. The Schanta operation is described and beautifully illustrated. But Wilfred Shaw does not show any great enthusiasm for this operation. The Wertheim operation receives a very detailed description of the various techniques and the stages of the operation are profusely illustrated. Only a brief description of the combined abdomino-perineal methods, such as that described by Howkins, appears in the book but lymphadenectomy as a corollary to irradiation or other treatment receives some detailed consideration. Anterior exenteration is briefly described but it is not emphasized that this seems a much more reasonable procedure than does total exenteration leaving the patient with a wet colostomy. It is interesting to note that Shaw advises total hysterectomy for discovered cases of "carcinoma in situ" largely on the assumption, with which not everybody will agree, that the "condition is certain to become invasive at a later date" (p. 141). The recommendations for treatment of cancer of the uterine body run on accepted lines and Shaw prefers an extended operation of the Wertheim type followed by irradiation for all anaplastic tumours of the uterine body.

Then follow several chapters (Nos. 9–16) which are on orthodox lines and present standard methods of treatment. But in Chapter 17 "Vaginal Hysterectomy" though very well described, does not find much favour with Wilfred Shaw for cases in which there is not an appreciable degree of prolapse.

The next chapter, chapter 18 on "Prolapse," deserves some detailed consideration. The anatomy is well described and follows the lines which the reviewer believes to be correct but with which some gynæcologists will be in disagreement. It is good to read that "Pessary treatment should be regarded as obsolete except in patients who are bad surgical risks". Shaw then proceeds to discuss his operation for anterior vaginal repair but whether this be performed as a separate operation or whether it be done as a first part of a Fothergill operation, it seems to the reviewer that Shaw's technique is open to very adverse criticism in that what he describes as his "key suture" must tend to pull the cervix downwards and forwards, and this is the very antithesis of what is aimed at in the Fothergill operation.

The indications for vaginal hysterectomy and repair for prolapse are discussed but great elongation of the utero-sacral ligaments is not given the prominence it deserves. The technique which Shaw describes and illustrates might be adversely criticized in several respects by other operators who frequently perform this operation.

The Interposition operation receives more favourable recognition than is usual from British writers and the steps are clearly illustrated. Other seldom-performed operations such as Wertheim modification of the Interposition operation, the Spalding-Richardson operation and Le Fort's operation are also described, as are various operations for the cure of hernia of the pouch of Douglas.

The chapter on recto-vaginal fistula and complete perineal tear follows orthodox lines but that on stress incontinence could not be so described. This symptom is attributed to weakness of that part of the endopelvic fascia (or connective tissue) which the author calls the posterior urethral ligament. He describes his vaginal plastic operation which draws up and lengthens the urethra and supports the urethro-vesical junction. But he points out that all the methods of vaginal plastic repair sometimes fail.

He then proceeds to describe some of the Sling operations. He is not pleased with his personal results from the Aldridge operation and he gives a detailed description of his own method which can be severely and adversely criticized since it involves opening up cancellous bone into a field which is potentially septic; for his sling is fixed to holes drilled in the bones of the pelvic girdle.

The simpler gynæcological operations on the cervix, uterine cavity, urethra, vulva, &c., are well described in four chapters towards the end of the book. These chapters also contain the description of certain major operations, e.g. for the repair of a bicornate uterus and the methods of forming an artificial vagina. The chapter devoted to surgery of the vulva also contains a long description of the anatomy and the surgery of radical excision of the vulva but the division of the inguinal ligament is regarded as something to be done only "if necessary".

Chapter 25 is a long and admirable display of the many surgical methods of treating a vesico-vaginal fistula and well merits detailed study by any gynæcologist who is called on to perform one of these operations without any great previous experience.

Chapter 26 is a valuable exposition on operative trauma to the bowel, to the bladder or the urethra, on uretero-colic anastomosis, &c.

Chapter 27 gives a brief account of some of the more usual non-gynæcological abdominal operations which a gynæcologist may be called on to perform and with the technique of which all gynæcologists should be conversant.

Chapter 28 deals with Cæsarean section and hysterotomy and Chapter 29 with methods of terminating pregnancy.

In conclusion we can agree with the publishers in their preliminary "note" that: This book is a tribute to a great man.

Thoracic Surgery. By R. H. Sweet, M.D. 2nd edition. (Pp. xxvi+382. 50s.) Philadelphia and London: W. B. Saunders Co. 1954.

Following the favourable reception of the first edition of this volume, Dr. R. H. Sweet has been enabled to make many minor alterations and a few additions in this second edition.

The surgical anatomy of the chest is adequately described although the illustrations, bunched together at the end of the chapter, are not as closely related to the text as they might have been. However, the illustrations throughout are profuse and excellent.

All the standard operations upon the lungs, mediastinum, pleura, œsophagus and diaphragm are clearly set out. General surgical considerations and post-operative management are also dealt with.

Dr. Sweet's great experience in thoracic surgery is well illustrated by his descriptions of surgical technique. This book should be of value to general surgeons who wish to extend their sphere of operations to the thorax. The indications for and results of the operations described are not considered. It is an entirely practical volume, though the style is somewhat dogmatic at times. The techniques described are orthodox with the personal modifications of the author. There are very few allusions to the work of other surgeons and no references are included.

The general production and type are of a very high standard.

Recent Advances in Dermatology. By W. Noel Goldsmith, M.A., M.D., F.R.C.P., and Francis F. Hellier, O.B.E., M.A., M.D., F.R.C.P. 2nd edition. (Pp. 461; 5 coloured plates and 28 figures. 42s.) London: J. & A. Churchill Ltd. 1954.

The feeling of any reviewer of this book must be one of profound relief that he himself did not have to share in its preparation. During the eighteen years since the first edition was published there have been striking advances in dermatology, many intriguing controversies and a good deal of confused thinking and writing. To summarize, synthesize and co-ordinate these things must have been labour at which Hercules would have boggled and is altogether horrible to think about. The child of all this labour is one of which its parents can be proud, one which will be welcomed by dermatologists the world over. This book will be the starting point for many who seek to put their views on paper not only because of its text but because of the many references collected at the end of each chapter.

Fourteen chapters cover virtually the whole field from mineral metabolism, through the collagenoses (wretched word), the endocrine glands, allergy, radiant energy to a fascinating miscellaneous collection in the last chapter but one. Inevitably much of this is hard reading, consisting as it does of a review of the literature; an attempt is made to present several points of view on one subject; sometimes this reviewer wanted fewer excerpts from other people's work and a little more evidence of the bias of the authors. Now and again the personal opinion is there but always as a small voice. The writing is pedantically correct; in the middle of a stiff passage a less fussy style might perhaps make the reading and the understanding easier. The work is so comprehensive that seeking what might be missing is more interesting than any television quiz. These absentees are few and insignificant. I can but thank the authors, doff my hat to them and tell every dermatologist to buy it. The general physician can learn from it too.

Textbook of Operative Surgery. By Eric L. Farquharson, M.D., F.R.C.S.Ed., F.R.C.S.Eng. (Pp. viii + 853; 623 illustrations. 75s.) Edinburgh and London: E. & S. Livingstone Ltd. 1954.

Farquharson's Operative Surgery is a book that can be recommended without hesitation. It is designed to give a young surgeon starting in practice the detailed help he needs in performing the standard operations of surgery, and to indicate to him the scope of the more unusual ones. In this aim it succeeds admirably.

Such criticisms as may be made are of points of view rather than of fact. The author's Edinburgh training appears in the allotting of eight pages out of eight hundred to the dissection of tuberculous glands in the neck; a London surgeon would give the advice of *Punch* to those about to get married. The retrograde injection of the saphenous channel in the Trendelenburg operation (p. 63), conservative amputations for bone sarcoma (p. 139), and routine amputation above the knee for senile gangrene (p. 231), radiating incisions for the removal of simple tumours of the breast and an elliptical incision placed diagonally for simple mastectomy—these are methods that surgeons in the south are tending to abandon. Some statements reflect views that are no longer held, and they will probably be changed or modified in the next edition. To give a sick man 9 litres of intravenous fluid (p. 566) is highly dangerous teaching; it may have been done, but it would have been better to keep quiet about it. The statement that colectomy will be required in only about half the cases after ileostomy for ulcerative colitis (p. 610) does not represent present opinion. The repair of herniæ by skin transplants (p. 696) has been tried and found wanting.

The illustrations are for the most part admirable, but Fig. 325 (Heller's operation) should be replaced by one that shows some knowledge of the peritoneal relations of the stomach. The reader of a textbook on operative surgery does not need much anatomical information, but he should be told where the anatomy of the body differs from the conventional anatomy of the anatomist. On p. 560 the myth of the pelvic mesocolon is perpetuated. Any surgeon knows that the fusion of the pelvic mesocolon with the left wall of the pelvis is part of the third phase of intestinal rotation, and a completely free pelvic colon is much rarer than an unfixed right colon, and more likely to undergo volvulus.

These are minor failings. The amount of essential information that the author has been able to pack into these pages is phenomenal. A review of the principles on which treatment is based precedes most of the sections, and these discussions will be of the greatest help to the young surgeon. The method of testing for compatibility previous to transfusion (p. 74), general considerations in the surgery of joints (p. 142), the principles of hand surgery (p. 180 *et seq.*), the management of intestinal obstruction (p. 564), instruction in the use of the proctoscope and sigmoidoscope (p. 617) and of the cystoscope (p. 716)—these sections are admirably clear and practical. The discussion on the treatment of head injuries (p. 710) is most helpful. The section on the treatment of hand infections is a refreshing change from the current teaching in London: "give them penicillin and let the pus point." In the surgery of the limbs the anatomical approaches of A. K. Henry are rightly emphasized.

The illustrations of operative procedure by Miss McLarty could not be bettered. This textbook, as are all those coming from the House of Livingstone, is beautifully produced, well able to stand up to the hard use it will get from the surgeons of all ages who will consult it.

Section of Proctology

President—T. McW. Millar, F.R.C.S.Ed.

[*March* 19, 1954]

Meeting in Edinburgh

Operations were performed at the Royal Infirmary by: Sir James Learmonth, Mr. K. Paterson Brown, Mr. R. Leslie Stewart, Mr. T. McW. Millar, Mr. W. A. D. Adamson.

The following Cases were shown at the Royal Infirmary:

Ulcerative Colitis.—Mr. W. Quarry Wood.

Ulcerative Colitis in Infancy (Two Cases).—Mr. J. J. Mason Brown.

Some Unusual Cases of Colon Disease.—Mr. John Bruce.

Some Factors Influencing the Choice of Operation in Portal Hypertension.—Mr. A. I. S. Macpherson, Dr. J. Innes, Dr. J. A. Owen.

The following short Papers were read at the Wilkie Surgical Research Laboratory, University New Buildings:

Presacral Tumours.—Prof. Norman Dott.

Duplication of the Rectum.—Mr. F. H. Robarts.

Anæsthesia for Operations on the Rectum.—Dr. John Gillies.

Colitis Cystica.—Mr. I. S. R. Sinclair.

Implantation from Carcinoma of the Rectum.—Mr. W. P. Small.

Carcinoma of Rectum with Calcification.—Dr. A. J. Sangster.

Some Physiological Aspects of Hypothermia.—Dr. E. J. Delorme.

The Uses of Electromyography to Investigate the Innervation of the Anal Sphincter.—Mr. G. W. Milton.

The Hepatic Circulation during Upper Abdominal Surgery.—Mr. H. B. Torrance.

A Demonstration was arranged of the Large Sections used in Investigation of the Spread of Carcinoma of the Rectum by Mr. W. Quarry Wood and the late Sir David Wilkie (1933).

[*May* 21, 1954]

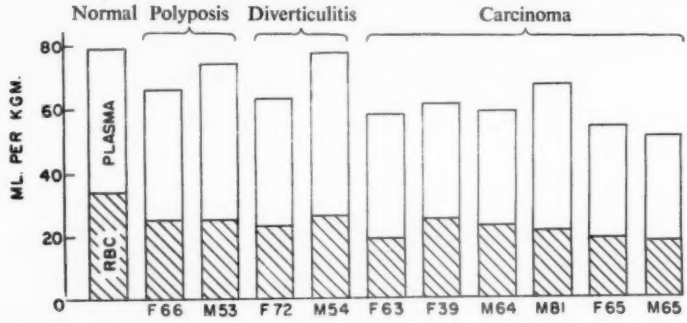
DISCUSSION ON MODERN TECHNIQUES IN THE SURGERY OF THE COLON

Professor Frederick A. Coller (The Department of Surgery, University of Michigan Medical School, Ann Arbor, Michigan, U.S.A.):

Early diagnosis of a lesion of the colon with a careful evaluation of the patient's condition is all-important. The advances in surgical technique have been most importantly those related to recognition of the chemical and physiological changes in the patient caused by disease, notably anæmia, malnutrition, dehydration and other changes associated with intestinal obstruction. If we broaden the discussion to include all lesions of the colon we must include in our pre-operative survey psychogenic and embryonic abnormalities. Along with the recognition of these abnormalities methods for their correction have been developed. Most of them must be carried out before the operative or mechanical phase of treatment is initiated.

Preparation for Operation

Patients with disease of the colon have usually been on a substandard diet for some time before hospitalization and consequently have a low total body protein in addition to depleted carbohydrate and fat stores. Sufficient hepatic glycogen must be provided to support the patient during the stress of anæsthesia, operation and convalescence. A positive nitrogen balance is much to be desired before operation since protein is essential for proper healing of wounds and important to other phases of the stress reaction. Because a negative nitrogen balance occurs for the first few days following operation, an excess of available protein should be present to cover this loss. Also in the absence of sufficient carbohydrate, protein will be converted to carbohydrate thus depriving the body of the essential function of protein itself. A high protein, high carbohydrate diet during the time of preparation will be helpful in bringing the patient successfully through the surgical procedure and the convalescent period. Supplementary vitamins, especially ascorbic acid, another necessary component of the healing process, should be included. In patients who cannot or will not eat, parenteral administration of carbohydrate, protein, vitamins and water must be resorted to. In the presence of a normal blood volume, the serum protein level is a good indication of the status of the body protein.



		F 66	M 53	F 72	M 54	F 63	F 39	M 64	M 81	F 65	M 65
Hb. grams %	15·5	14·4	12·3	14·7	13·3	12·5	16·4	14·3	12·5	13·7	13·4
Hæmat. Vol. %	45·0	41·6	36·8	41·3	37·7	36·8	45·2	43·2	35·4	38·2	39·1
Vol. def. %	0	16·4	6·4	20·8	2·4	26·4	22·4	25·0	15·2	31·8	35·0
Hb. def. %	0	22·2	25·7	24·8	16·2	15·5	18·0	28·6	31·8	53·8	43·8

FIG. 1.—Comparison of blood volume and hæmoglobin deficits determined by the Evan's blue dye technique with hæmoglobin and hæmatocrit values in the normal and in a series of patients with disease of the colon. The sex and age of the patient are given directly beneath each bar.

But many patients may have a low blood volume that is not reflected in the examination of the blood. Normal hæmoglobin and hæmatocrit determinations are not an index of a normal blood volume. As shown in Fig. 1, there may be marked hæmoglobin and volume deficit and yet a relatively normal hæmoglobin and hæmatocrit value. Therefore the determination of the total blood volume and red cell volume and their restoration to the calculated expected normal for the individual by the use of whole blood before operation is definitely indicated in these cases. Patients in the older age groups with carcinoma of the colon or other lesions causing weight loss, are usually the ones found to have a low blood volume which often would be unrecognizable without actual volumetric determination. Occasionally those in the younger age groups about to undergo colectomy for chronic ulcerative colitis will have a dangerously low blood volume. Blood volume determination, although more tedious an undertaking than calculating hæmoglobin or hæmatocrit values, can be done with relative ease using Evan's blue dye, T 1824. The administration of whole blood during the preparation period in addition to restoring the volume and red cell mass to normal will, of course, also add to the body stores of protein.

Sterilization of the bowel has been so stressed in recent years that many young surgeons think an anastomosis will not be successful in its absence. Pre-operative bowel sterilization with the antibiotics has perhaps lowered the morbidity rate and probably the mortality rate of colon surgery but if the patient is in good nutritional balance and the established principles of bowel surgery are carefully followed, its value is negligible. An anastomosis does not heal because it is in a sterile field but because it has been done with minimum trauma, has a good blood supply and is not under undue tension. The peritoneum can always handle a single contamination which may occur during the performance of an open anastomosis without the development of generalized peritonitis. Peritonitis occurs with continuing contamination from a hole in the bowel, such as a leak in an anastomosis. This is not to imply that the various agents are not used but only to caution against too much reliance upon them as the determining factor in the success of the operation. A daily oral dosage of eight grams of Sulfathalidine in divided doses for five days seems to be the safest and most efficient method of reducing the bacterial flora to its minimum. Sulphasuxidine in similar dosage is likewise effective. Most of the antibiotics including Aureomycin, Terramycin, neomycin, erythromycin and carbomycin will also suppress bacterial growth and in a shorter time. However, a 20% incidence of side-effects occurs from the use of these agents. Anorexia, nausea, vomiting, diarrhœa and anal pruritus are the most common complications. They are usually not serious and will subside upon discontinuing the antibiotic. Neomycin can result in damage to the VIII nerve if used over too long a period. The suppression of *Escherichia coli* by the antibiotics gives resistant micrococci or monilia, especially *Candida albicans*, the chance to propagate and replace the normal bacterial flora and occasionally a severe enteritis with ulcerated lesions of the mucosa develops. Suppression of *Escherichia coli* interferes with the absorption of vitamin K and consequently with the hepatic production of prothrombin. Therefore it is essential that the patient be given parenteral vitamin K during the pre-operative period and that the prothrombin level of the blood is normal before operation.

Daily purges are not necessary in the preparation of the bowel and when employed may well exhaust and dehydrate the patient. Sulfathalidine usually has enough cathartic action to cleanse the

bowel and when combined with a soapsuds enema on the morning of operation will leave the bowel sufficiently empty so as not to interfere with any operative procedure. In patients partially obstructed but not requiring surgical decompression as part of their preparation, more vigorous enemata and cathartics may rarely be needed.

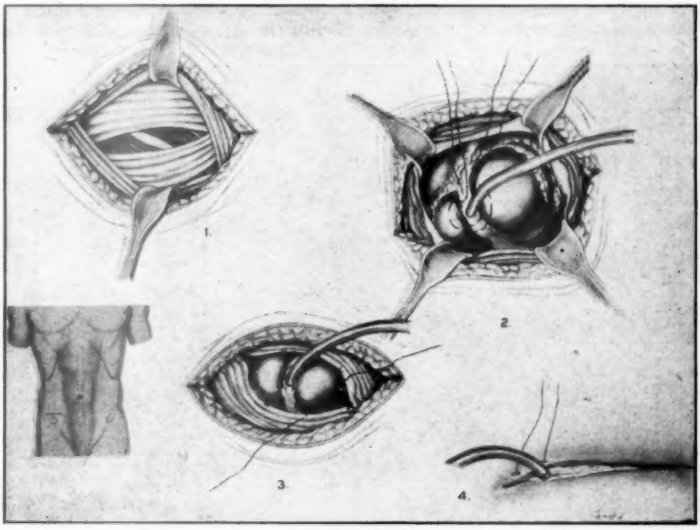
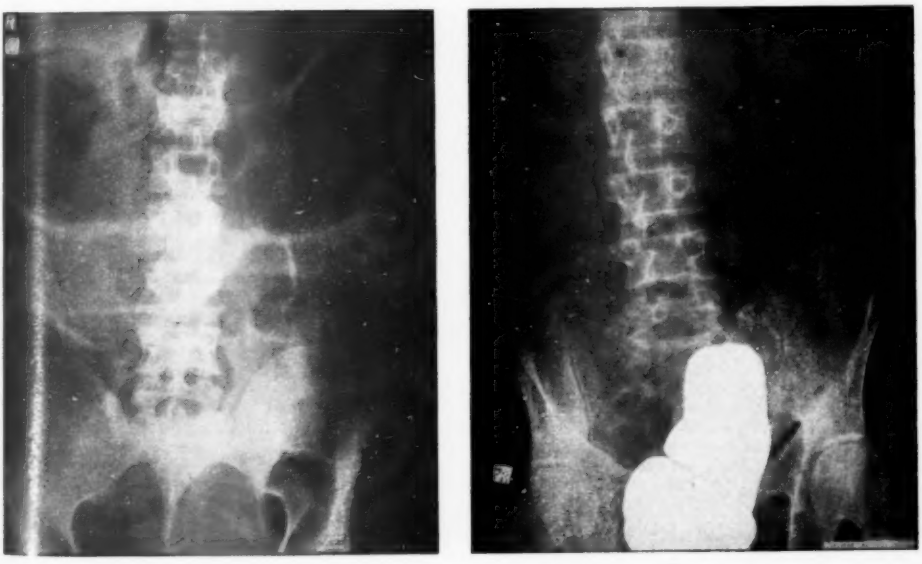


FIG. 2.—Technique of cæcostomy. A transverse incision is made in the right lower quadrant. The flat muscles are split and the peritoneum opened (1). A catheter is inserted through an opening in the cæcum along the tænial band and two purse-string sutures are placed (2). The cæcum is attached to the peritoneum (3) and the wound closed (4).



A B

FIG. 3.—Carcinoma of the sigmoid with obstruction. A, Marked large bowel distension. Competent ileocæcal valve. B, Decompression by cæcostomy. Complete block demonstrated by barium enema.

Not infrequently the patient is first seen with acute obstruction. This occurs most commonly in carcinoma of the left colon, although occasionally a transverse colon carcinoma may cause acute obstruction. Such cases require decompression of the acute large bowel obstruction in addition to the other preparatory measures before definitive operation can be safely undertaken. In addition, serious electrolyte disturbances are often present due to the loss of large amounts of fluid and electrolytes into the obstructed bowel. Whether or not the ileocæcal valve is competent, acute large bowel obstruction is a surgical emergency. The distension of the colon, as visualized on flat-plate X-ray

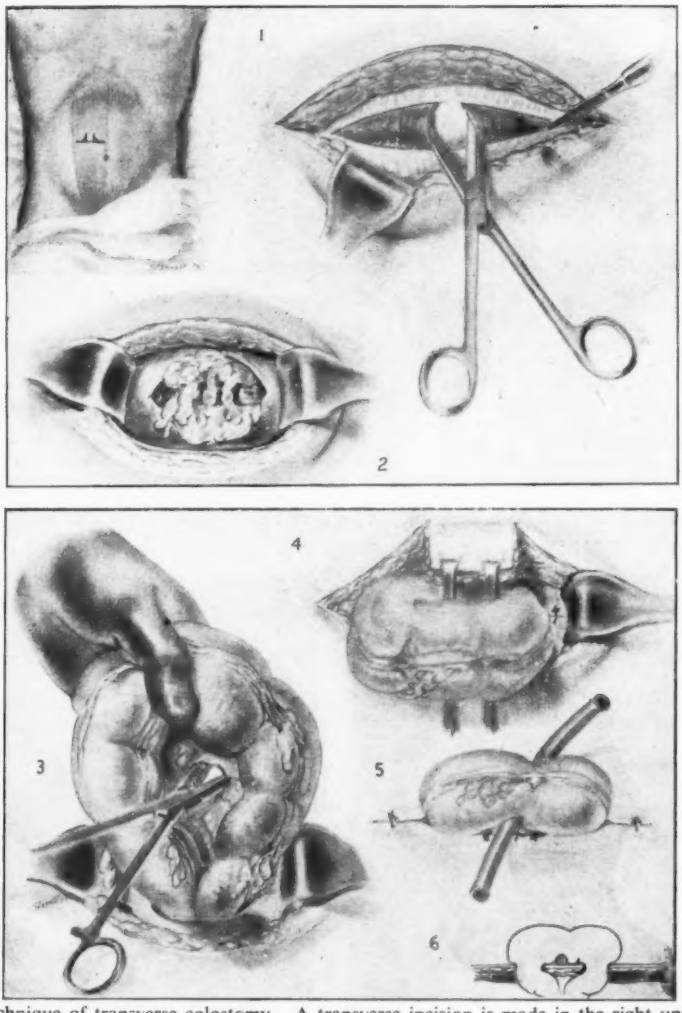


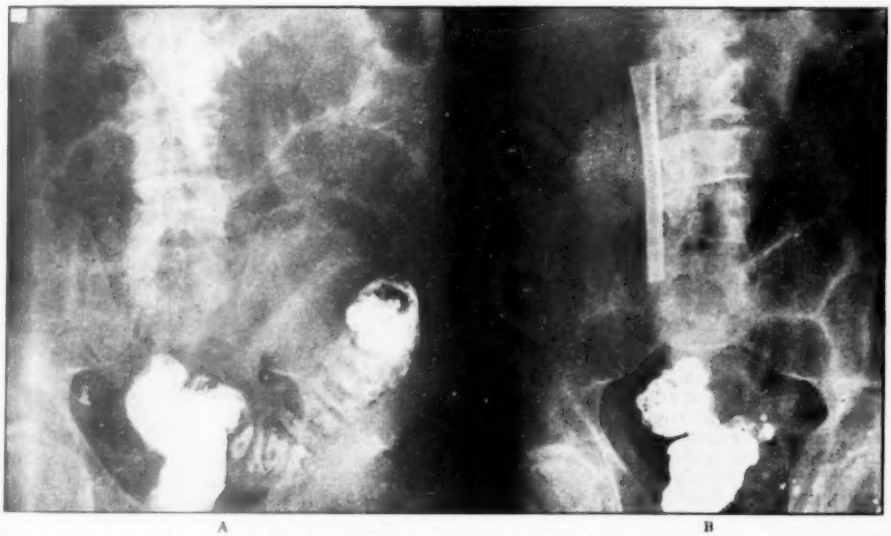
FIG. 4.—Technique of transverse colostomy. A transverse incision is made in the right upper quadrant. The rectus muscle fibres are spread apart (1) and the peritoneum opened (2). A loop of transverse colon is exteriorized and a small hole is made in its mesentery (3). A skin bridge is brought through this hole and sutured (4) and a tube is placed beneath the colon (5).

examination of the abdomen, comprises its own blood supply and perforation, usually of the cæcum, may occur. Decompression by a long tube of the Miller-Abbott or Cantor type is not sufficient even if the ileocæcal valve is incompetent. Cæcostomy or transverse colostomy is urgently indicated. If the ileocæcal valve is incompetent, the use of a long tube should be added to the surgical decompression. In most instances a cæcostomy is a simple and satisfactory means of decompression (Fig. 2). Since

the contents are usually gas, a small vent will suffice to allow decompression (Fig. 3A and B). In certain cases, particularly where the complete obstruction has gradually occurred and a large amount of fæcal material may be present in the colon, transverse colostomy is a better means of decompression (Figs. 4 and 5 A and B). It is a larger procedure and requires a formal closure which makes it less desirable for the average case.

Significant electrolyte disturbances are not usually present in non-obstructing carcinomas of the colon, although they may be marked in the obstructed colon. In severe inflammatory lesions of the bowel, especially in ulcerative colitis, chemical equilibrium is usually upset. Determination of the serum sodium, potassium, chloride and carbon-dioxide combining power, in addition to the blood non-protein nitrogen, are indicated in such instances and replacement carried out as indicated. There is usually need for sodium, potassium, bicarbonate and water. Lactate-Ringer's, hypotonic saline or Hartmann's solution are the best replacement solutions with supplemental potassium chloride. 5 or 10% glucose, invert sugar or fructose in water is also given to correct the water and carbohydrate depletion.

The cardiovascular system needs careful evaluation, especially in elderly patients and those with a history of heart disease. Actual or impending congestive failure may indicate a course of diuretics and digitalization before operation. It is rarely necessary to defer operation long in such cases and it is encouraging to see how well these patients tolerate operation once supportive measures have been instituted.



A B

FIG. 5.—Carcinoma of the rectosigmoid. Barium demonstrates point of complete obstruction in A. Marked distension of the cæcum. B, Improvement following transverse colostomy.

The renal status of the patient should be investigated. A normal daily urinary output, the ability to excrete a concentrated urine on low fluid intake, and absence of abnormal findings in the urine analysis usually indicate an adequate renal function. In elderly male patients being prepared for combined abdominoperineal resection for rectal carcinoma, the condition of the prostate gland should be carefully evaluated. Such patients are prone to urinary retention following operation and if benign prostatic hypertrophy is present to a marked degree, preliminary transurethral resection may be indicated, but it is usually better to use constant drainage and to do this operation if necessary after the definitive operation has been carried out.

On the morning of the operation it is well to insert a tube into the stomach to keep this organ empty during the procedure and for the first day or two following operation, the time depending upon the outflow. A small indwelling catheter is placed into the bladder in cases where a resection of the distal colon or rectum is planned.

The attitude of the patient towards his disease and operation has much to do with the rapidity of his recovery. If a permanent colostomy or ileostomy is to be done, the patient should know this and should also know that its presence does not preclude an active and happy existence. The ability to communicate to the patient a sense of optimism concerning the final outcome, even when the prognosis is not favourable, pays dividends in the form of shorter, smoother convalescence for the patient.

Operative Procedures

Intravenous sodium-Pentothal induction followed by nitrous oxide and ether by way of closed system is not objectionable to the patient, allows sufficient oxygen to be supplied at all times, and has a wide margin of safety. The use of the curare-type muscle relaxants with their attendant dangers is rarely necessary with this method. Endotracheal intubation provides an exact control of the anæsthesia and the patient. Numerous other agents and combinations are successfully employed but in our hands this programme produces the best results.

Before the operation begins an intravenous drip of 5% glucose in water is instituted. This is replaced by blood as soon as blood loss occurs and throughout the operation blood replacement is kept equal to blood loss. No saline is given during operation or in the immediate post-operative period and the fluid given is only such as to cover the fluid losses from the lung and skin and to anticipate the needs of the kidney.

The transverse incision or modifications of it is recommended for all operations on the colon. It most nearly approaches the anatomical and physiological ideal in that segmental nerve supply to the abdominal wall is least damaged and thus wound healing and strength is more satisfactory. The transverse incision is parallel to the line of pull of the flat muscles of the abdomen and consequently there is no tension produced upon the wound by the contraction of these muscles during the repair period. Post-operative pain is considerably less than with vertical incisions and therefore fewer narcotics are necessary, a better respiratory exchange is maintained, refusal to cough because of discomfort is not a problem and early ambulation is easier for the patient. Adequate exposure for any procedure upon the colon can be obtained by correctly placing the transverse incision, Fig. 6.

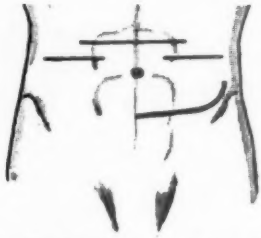


Fig. 6.—Sites of transverse incisions. The incisions shown are suitable for resections of the right colon, transverse colon and left colon. The incision in the left lower quadrant is used for low sigmoid and combined abdominoperineal resections.

The objective in operations for cancer is twofold: to remove the primary tumour and in so far as possible to excise the routes over which the neoplastic cells have spread. As yet hæmatogenous spread is not amenable to surgical treatment except in the occasional case in which a solitary hepatic metastasis may be removed by partial resection of the liver. Direct extension is most easily controlled by the resection of a wide area of tissue surrounding the lesion. Lymphatic dissemination is not only the most common type of spread but the most challenging. The epicolic nodes about the lesion, the paracolic nodes along the colon proximal and distal to the lesion and the intermediate and principal nodes following the path of the blood-vessels to the colon must be removed in continuity with the primary lesion.

Solitary colonic polyps should be removed once they are discovered because of the frequent tendency for carcinoma to originate in them. Wedge resection of the polyp-bearing portion of the colon with an adequate cuff of normal tissue above and below is the ideal treatment. Rectal polyps may be removed through the sigmoidoscope if they are small and when it is possible completely to excise the polyp and its base. Polyps of the rectum of any magnitude are best removed by posterior proctotomy. Incision is made over the tip of the sacrum and coccyx, the coccyx resected, and dissection carried to the posterior wall of the rectum. This is incised longitudinally, the polyp and an area of adjoining normal mucosa excised and the rectum closed transversely in layers. Multiple polyposis demands total colectomy at an early date since carcinoma will inevitably supervene.

Patients with chronic ulcerative colitis which does not rapidly respond to medical measures, and in our present ignorance of its ætiology, should receive surgical treatment at an early date. Definitive operation performed before the patient becomes a chronic invalid will return a much larger percentage of these cases to a productive life. Definitive operation consists of a one-stage total colectomy and ileostomy. If the rectum is severely involved it can be removed at the original operation. However, if the nature of the rectal involvement is such that ileosigmoidostomy is a possibility in the future, it may be spared.

Small bowel dysfunction and intermittent episodes of intestinal obstruction frequently

encountered following ileostomy are in many cases due to constriction of the stoma at the level of the abdominal wall. This can be avoided by constructing the ileostomy as shown in Fig. 7 (Crile and Turnbull, 1954). The end of the ileum is brought through the stab wound in the right lower quadrant a distance of about 3 in. A circular incision down to, but not through, the mucosa is made 1·5 in. from the end of the ileum. The seromuscular layer is then stripped from the distal 1·5 in. of the ileum, leaving the mucosa intact. The mucosa is then inverted over the remaining exteriorized ileum and sutured to the skin or external oblique fascia. No other sutures are placed in the ileostomy and no tubes are placed in the stoma. Constructed in this manner, the ileostomy functions well and stomal constriction does not occur. Disposable plastic bags cemented to the skin are the best appliance in the early post-operative period.

The actual technique of restoring continuity of the colon following resection varies among surgeons. A satisfactory anastomosis will be obtained provided there is normal blood supply to the ends, the serosa is accurately inverted and approximated, no tension is on the suture line and tissues are gently handled. Where the two ends of the bowel are of approximately equal size, end-to-end anastomosis is usually most satisfactory. In resections of the right colon and terminal ileum and in resections of the sigmoid with a small distal segment remaining, end-to-side repair is most feasible. Closed anastomoses can be performed but an open anastomosis provides more accurate approximation of the layers. Interrupted four zero silk sutures are used in all layers. The first posterior layer unites the seromuscular coats of the ends and consists of interrupted Lembert or Halsted stitches. The

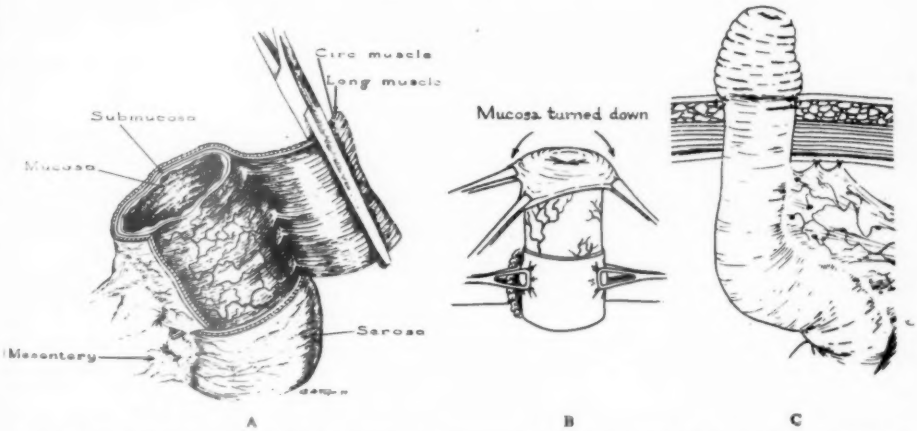


FIG. 7.—Surgical maturation of the ileostomy. A, Demuscularization of the distal half. B, Eversion of the mucosa-submucosal coats. C, Finished ileostomy showing complete protection of the serosa. (Reproduced from Crile and Turnbull, 1954, by permission of the authors and of the Editor of the *Annals of Surgery*.)

second posterior layer is a row of simple through and through stitches uniting all layers including the mucosa. The first anterior row may be of interrupted Connell type sutures or better the suture which is illustrated in Fig. 8, which serves the purpose of both hæmostasis and inversion. The final anterior row is again of interrupted Lembert or Halsted type.

Closure of the abdominal wall is with interrupted stitches of stainless steel wire in the peritoneum and fascial layers and continuous wire in the subcutaneous tissue and skin. The subcutaneous and subcuticular wires are pulled out when healing is complete, a period of seven to ten days. This method of closure using a suture material which is the strongest and causes the least tissue reaction of any is least likely to be complicated by wound infection or disruption, and once healed leaves an abdominal wall in which incisional hernia rarely develops.

POST-OPERATIVE CARE

As the patient recovers from the anæsthetic, close supervision, preferably in a room set aside for this purpose, is indicated. Regular cleansing of the pharynx and trachea by means of suction until the patient regains his cough reflex will help to prevent pulmonary complications. Oxygen by nasal catheter is administered during the first few hours following operation.

Suction on the nasogastric tube is continued a day or two following operation until peristaltic sounds return or until gas is passed by rectum. This will not only keep the stomach empty and

prevent vomiting but will to a large degree keep the small bowel decompressed. 2,500 to 3,000 ml. of 5% glucose in water, is administered daily by the intravenous route to provide for insensible loss and urinary flow. Electrolytic solutions are needed only to replace electrolyte loss which occurs from the gastric suction. In any case where it has not been entirely replaced, blood is administered.

Antibiotics, usually penicillin and streptomycin, are prophylactic in helping to prevent pulmonary infection and in aiding the peritoneum to combat the soiling that may have occurred during the performance of open anastomosis. Narcotics are employed sparingly, only to alleviate pain. When transverse incisions are used, pain is rarely a complaint for more than a day or two and thus the opiates need not be used in large doses for a very long period.

Whether or not early ambulation prevents thrombo-embolic venous complications is a moot question, but it certainly shortens convalescence in that muscular tone is rapidly restored, the activity of the gastro-intestinal tract resumes more quickly and the patient develops an optimistic outlook. A few steps should be taken the day following operation and gradually increasing activity thereafter is urged. It is well to give support to the leg veins for a week or two in the form of elastic bandaging. This is a simple measure to carry out and by accelerating venous return, helps to avoid the initiation of venous thrombosis.

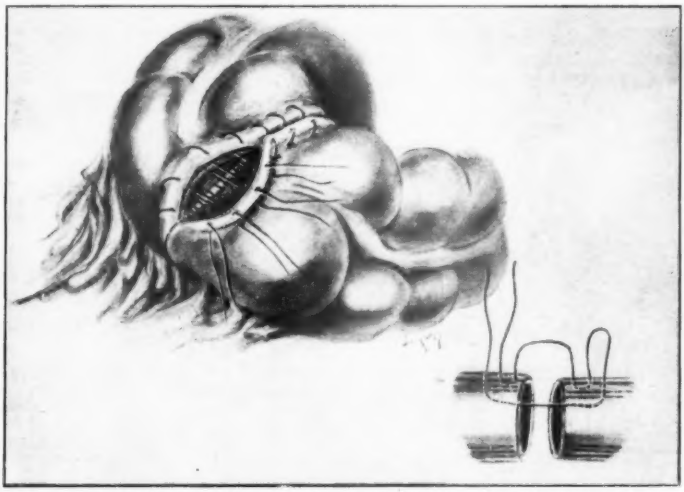


FIG. 8.—The stitch used in the first anterior row of an open anastomosis. It both inverts and is hæmostatic.

There is no necessity to withhold food for long periods. The best index as to when the patient should eat is when he is hungry. This usually occurs on the third or fourth day following operation. If one trial of soft and liquid food is well tolerated a regular diet should be offered. The soft and liquid diets are far from palatable in most hospitals and do little to bolster the returning appetite

Skin sutures remain in place at least seven days. They may be left much longer if there is suspicion that the skin edges are not firmly united since practically no tissue reaction occurs from wire.

On this programme recovery is rapid and complications few. Close observation with particular reference to the lungs, peripheral veins, urinary tract and the wound will detect complications at their inception. Most patients are ready to go home eight to ten days following operation. Upon discharge they need only be told to do whatever they feel able provided they rest when they become tired.

CONCLUSION

The assiduous application of all the measures suggested can further reduce the mortality rate of operations upon the colon. Attention to details of preparation and after-care are as important in obtaining good results as is a well-performed operation. Operative techniques are fairly satisfactory, diagnosis is unfortunately retarded, recognition of chemical and physiological abnormalities and their correction are all important before operative treatment is indicated.

I acknowledge my debt to Dr. William J. Regan for help in the compilation of data.

REFERENCE

CRILE, G., Jr., and TURNBULL, R. B., Jr. (1954) *Ann. Surg.*, **140**, 459.

Mr. John Bruce (Edinburgh):

When we come to discuss "modern techniques" it is well to remind ourselves that the basic problems of colon surgery were accurately defined and its principles soundly enunciated by that generation of surgeons whom many of us proudly recall as our teachers. Two who belong to this elect company are with us to-day—Cuthbert Dukes, who has made plain so much of the pathology of the large bowel, and Fred Coller of Ann Arbor who first directed surgical attention to the importance of fluid and electrolyte balance not only in operations on the colon, but in the whole wide field of surgery.

Strictly defined, "technique" is the method, or the detail of procedure, essential to expertness of execution in any craft. In a surgical context it implies much more than the mechanical steps of operation, important though these may be; it involves also the selection and the timing of operation, the preparation for it and the management afterwards. In respect of the colon, there is obviously room for divergence of opinion on almost any of these matters, so that it is apposite thus early in our deliberations to restate the dictum of another pioneer in colon surgery, unhappily prevented by grave ill-health from being in London this week. Fred Rankin once said:

"It is dogmatic to preach that any single method so far outdistances others that it is indispensable. Elements of personality and circumstance must necessarily influence the choice of technique; and therefore the range of manœuvre continues wide, and at the same time acceptable so long as fundamental principles are observed."

I have approached this discussion from the standpoint of a general surgeon obliged to deal with the general run of large bowel diseases in numbers that must approximate to the average for most general surgical units.

Operations on the colon are undertaken with two main ends in view:

(1) The relief of obstruction.

(2) The eradication of segmental or generalized disease.

Operations for the Relief of Obstruction

The death-rate from acute large bowel obstructions remains high; but since the majority are due to late carcinoma, and since the patients are usually old, we need not be unduly self-critical.

Two pathological considerations should govern our tactics in respect of acute large bowel obstruction.

(1) The segment of colon between the obstructing lesion and a competent ileocæcal valve will behave like a closed loop; the intraluminal pressure may, in fact, rise so high that tension necrosis may supervene and lead to perforation, or peritonitis may occur from the passage of organisms through the attenuated colon wall.

(2) In most instances, there is also a simple occlusive obstruction of the small gut, with all its attendant biochemical derangements.

Intestinal tube suction and fluid and salt therapy must therefore be started at the earliest possible moment; but under no circumstances should they be regarded as a substitute for surgery. It would, no doubt, be possible to coax a long tube along the small bowel and into the cæcum, but the time spent in such manœuvres may easily prejudice the vitality of the colon wall.

In fact, there is nothing to gain by postponing operation beyond the few hours necessary to improve the general state of the patient, for even when it is possible by conservative means to relieve an acute obstructive episode, the patient seldom thereby becomes a suitable subject for elective primary resection within a reasonable time. The proximal bowel remains œdematous, thick and dilated, and often there is mucosal ulceration also; so that a proximal colostomy is almost always advisable.

Technical Aspects

The most convenient access in acute obstructions is by way of a left paramedian incision, since most are due to malignant disease, and practically all of them are situated somewhere between the splenic flexure and the pelvirectal junction. Furthermore, foreign bodies become impacted in the descending or the pelvic colon; and volvulus is overwhelmingly more common in the pelvic colon than in the cæcum.

The first step in the operation should be to identify the distended transverse colon and to deflate it by needle and suction, a procedure first practised by Roscoe Graham of Toronto, but recalled to us by Andrew Lowdon of Edinburgh. The colon distension is almost purely gaseous, and with deflation it collapses, so that gentle manual exploration is made easy and accurate. The deflation is accomplished by inserting a fine, hollow needle very obliquely through a tænia so that its point just enters the lumen. Strong suction is then applied, and as the transverse colon empties, gentle pressure over the cæcum and over the distal colon will propel their gaseous content towards the needle. A moment's pressure with a flavine swab as the needle is withdrawn prevents subsequent leakage.

Volvulus of the Pelvic Colon

Deflation is also invaluable when a sigmoid volvulus is encountered at operation, either because attempts to relieve it by the passage of a rectal tube in the knee-elbow position have failed, or because

it has not been diagnosed before laparotomy. If allowed to prolapse, and so escape from the splinting effect of the abdominal parietes, the peritoneal and muscle coats usually split and subsequent suture of the thin colonic wall is both dangerous and difficult.

Deflation facilitates the unwinding of the volvulus; but how to proceed after that is a matter for consideration. The pelvic colon is grossly redundant, so that recurrence is common; it is often difficult to be certain about the viability of the bowel wall, especially at the site of the twist; and on at least one occasion I have known of later thrombosis in the mesocolic vessels with fatal gangrene of the sigmoid loop. Furthermore, these patients are elderly; and I would suggest that the procedure of choice is immediate exteriorization and resection. The limbs lie together so neatly that sutures are sometimes unnecessary; and the spur can later be crushed, or better, an open closure of the colostomy can be carried out.

Foreign Body Obstruction

In foreign body obstruction, it is sometimes possible to break up an enterolith; but a calcified body usually has to be removed by enterotomy. Such a stone is generally rough and excoriating, and it is a good plan to try to displace it proximally so that the incision can be made away from the area of contact. A transverse incision in the bowel wall is best because it interferes least with the radially disposed arteriæ rectæ, and it can be closed securely without reducing the capacity of the lumen.

Obstruction Due to Malignant Disease

In malignant obstructions there is no argument about the necessity for colostomy. I have until now favoured *remote colostomy*, that is, with a stoma placed in the proximal end of the transverse colon so as to interfere as little as possible with subsequent resection; but on a few occasions when secondary resection had to be undertaken after a colostomy had been established close to the growth, I have not encountered particular difficulty in removing the colostomy and the tumour in continuity. Indeed, the situation is thereby converted into one precisely similar to that of a simple primary resection, and the patient is then spared a further operation for closure of the stoma. I was interested to hear from Waugh of the Mayo Clinic that he is now electing to site the colostomy near to rather than remote from the growth. The argument against remote colostomy—that it is sometimes impossible to cleanse the segment between the stoma and the growth—is not really valid, however. If there is difficulty of this kind, a Cantor or a Miller-Abbott tube introduced into the distal stoma permits progressive evacuation and thorough irrigation.

My own preference is for a *loop colostomy* over a glass rod, and through a short separate incision, transverse and rectus-dividing in the case of a proximal transverse colostomy, oblique and muscle-splitting when the stoma is to be made in the pelvic colon. Complete transection of the loop is just as defunctioning as the Devine type of colostomy; and since the subsequent closure should be by the open method, there is no real advantage in the double-barrelled stoma. There is no need to stitch the gut to the peritoneum; with the colon deflated, and gastric or intestinal suction under way, the opening of the colostomy can safely and without discomfort be postponed for thirty-six hours, by which time the loop is safely insulated from the peritoneal cavity. If for any reason this is considered undesirable, a No. 30 rectal tube may be passed into the proximal limb through a tiny stab incision; this causes a minimum of wound contamination.

Cæcostomy.—I have found this operation unsatisfactory in acute obstruction, even when a knuckle of cæcum has been stitched to the peritoneum and drainage has been instituted by a wide catheter of the de Pezzer type. The drainage of fæcal matter tends to be irregular and incomplete; the subsequent pre-operative preparation of the colon is more difficult; and the protection of the skin is often a problem.

A blind cæcostomy through a McBurney muscle-splitting incision is sometimes claimed to be a life-saving measure for those in poor general shape as a result of late large bowel obstruction. This is questionable; it must be a rare event that a patient not inevitably doomed cannot be made fit enough, by a short and well-managed restorative programme, for laparotomy, deflation, gentle exploration, and an electively sited colostomy. I suspect that those who are saved by blind cæcostomy would equally well have survived the bolder course.

The advantages of this exploration are several; it may well disclose liver secondaries, peritoneal metastases, or such gross glandular invasion that an immediate decision of inoperability can be reached; and in this event a permanent colostomy can be accurately made close to the growth without further ado.

Modern resuscitative methods, skilled anæsthesia, and early gas decompression have so minimized the risks of open colostomy that blind cæcostomy is now virtually obsolete.

A valvular cæcostomy is occasionally—and successfully—employed to provide a "gas vent" after colostomy or colectomy. However, gas distension of the colon is due to swallowed air, and if the gut is thoroughly deflated during the operation, or before the peritoneum is closed, and if the slow re-accumulation of gas is prevented by gastric or intestinal tube suction, the need for cæcostomy is largely abolished. In any event, a long rectal tube is equally effective and less troublesome.

Operations for the Extirpation of Disease

Radical colon surgery may be called for on account of malignant disease or for simple lesions. The latter are in some ways the more important, in so far as the technical difficulties are often greater, and since the diseases are themselves not lethal, the penalty of error is all the more tragic.

The late Sir David Wilkie used to preach that there were two great No's in the surgery of the colon —no traction, no tension. The incision should be liberal, and so accurately placed as to make heavy retraction of the wound edges unnecessary; retractors are intended to hold aside, not drag apart. In resections of the right colon and for limited exposures of the pelvic colon, a lateral oblique incision is adequate, and free from any risk of dehiscence; removal of the transverse colon in whole or in part is easy through a transverse supra-umbilical incision which divides both recti; while for total colectomy and extensive left colon resections, a long left paramedian incision is quite the best, especially if posture is correctly employed, i.e. if the patient is tilted laterally in the appropriate direction when the vertical parts of the colon are being mobilized.

The healing of clean laparotomy wounds following colon operations presents no particular problem, and most of us by now have elaborated our own favourite technique of repair. The management of contaminated, or potentially infected wounds such as those for the drainage of a pericolic or pericæcal abscess is a different matter; and here the tension of a primarily sutured wound may have evil effects.

The fatty and aponeurotic layers of the abdominal wall are relatively avascular, with a low resistance to infection. In a closed wound, the infection may spread widely; tight suturing undeniably favours sloughing of the avascular tissue, and the subsequent repair is a slow business which greatly outlasts the intraperitoneal infection. To avoid this Wilkie adopted the principle of delayed closure which had emerged as the golden rule in the management of the limb wounds of World War I. Only the peritoneum and the deep muscular layers are closed; the skin and superficial planes left widely open, but sutures of silk or gut or wire are inserted, and held loosely on each side of the incision, the wound being lightly packed with flavine gauze or tulle gras. In a few days, the wound surfaces are covered with healthy granulations, and the stitches can then be tied. I have yet to see an incisional hernia following delayed primary suture, and I have used the method consistently for more than twenty years.

The virtue of draining the peritoneal cavity after radical colon surgery is still vigorously disputed. There are some who hold that the pressure of a tube drain against the bowel wall favours the development of a leaking suture line. Nevertheless, after resection for inflammatory conditions such as diverticulitis, where much mobilization has been necessary, the risks of a retroperitoneal hæmatoma and of retroperitoneal cellulitis under tension are sufficiently real to justify the use, not of a tube, but of a drain of soft dental rubber. I have not seen any untoward complication following this practice.

In the past, aseptic anastomosis did not prevent peritonitis, for it was due, not often to contamination at the time of operation, but to leakage at the suture line during the "lag period" in healing round about the third to the fifth day. A leaking anastomosis was almost invariably the result of tension—the tension of a taut anastomosis; the tension within a colon allowed to become over-distended with gas. Those surgeons who had come to appreciate this, and to avoid it by wide mobilization, minimal suturing of viable bowel ends, and the provision of a safety valve in the shape of a valvular cæcostomy or a rectal tube, had attained, without any of our modern resources, a mortality very near that of to-day. Thus for many years Wilkie relied with conspicuous success on an anastomosis constructed with a single layer of interrupted seromuscular stitches of fine silk, and a valvular cæcostomy.

Chemotherapy may have diminished the consequences of leakage—and it has certainly abolished the need for the so-called "aseptic" or closed methods of anastomosis. Nevertheless, established principles can only be offended at grave peril.

Adequate mobilization of the bowel is perhaps the crux of the technical problems of colon surgery. Only in the ascending and descending colon—and possibly at the splenic flexure—is this sometimes difficult. In the vertical parts, free mobility is denied by the extraperitoneal connective tissue, the fascia propria, and in inflammatory conditions such as diverticulitis, this is generally thick, tough and vascular. Not force but strategy is needed in such circumstances; the division of the peritoneum and the fascia should start well lateral to the bowel, so that a proper plane of cleavage is defined between the peritoneum and the posterior abdominal wall. The use of diathermy cuts down the bleeding considerably. The ureter should be identified early, and its safety thereby ensured. Mobilization of the splenic flexure is best carried out after both the upper part of the descending colon has been mobilized, and the left half of the transverse mesocolon has been divided. The left hand of the operator can then grasp both limbs of the flexure, and by gentle traction, with the patient slightly in the reverse Trendelenburg position, it is a simple matter to divide the phrenico-colic ligament, and to lift the whole of the left colon out of the abdomen.

In non-malignant lesions, the amount of colon to be removed is determined by the pathological limits of the disease; and since the resection is not conditioned by vascular or lymphatic anatomy, there should be no difficulty in securing bowel ends which bleed generously from the cut surface. Free bleeding is, in fact, the best criterion of really viable bowel ends; but even so, coarse suturing in many layers, or suturing under tension, may cause subsequent vascular occlusion, and necrosis.

Enough slack at the two ends to allow them to lie easily together, and to permit an accurate open anastomosis without drag and with minimal suturing, is the only insurance against disaster.

The initial layer of sutures should be of the finest catgut, inserted on the lock principle and joining only the mucous membrane, which is the best safeguard against subsequent stenosis. The muscle and peritoneal coats are sutured with fine silk or linen separately from the mucosa; in this way the distracting influence of the longitudinal muscle of the tæniæ on isolated parts of the mucosal suture is avoided, a point of technique which Wilkie termed "mobilization" of the muscle coats, and to which he attached great importance.

If a sound mucosal suture is obtained, wide clearing of the colic fat from the bowel ends is unnecessary, and, indeed, unwise, for it is very easy then to damage important mural vessels.

The seromuscular stitches should be interrupted, and should take only a modest bite, so that nothing in the nature of an inverted ledge or diaphragm results; and the gap in the mesentery is most safely closed, not by stitches which, in stout subjects can so easily occlude an important vessel, but by the simple expedient of applying a hæmostat to each edge and encircling both in a common ligature.

Technical Considerations in Radical Operations for Diverticulitis

Mobilization of the colon can be at its most trying in diverticulitis. It is of paramount importance to establish the anastomosis well clear of the disease; for former peridiverticulitis makes the certainty of a sterile operative field somewhat doubtful, and antibiotic preparation may be less effective because of stagnation and inspissation of contents in the diverticula.

Resection is generally called for in disease of the pelvic colon, and usually some time after a proximal colostomy has been established. As the inflammation subsides, however, the affected gut tends to contract, and it is practically always necessary—or advisable—to mobilize the splenic flexure and the whole descending colon in order to secure an anastomosis without tension. A long left paramedian incision is therefore the approach of choice.

After prolonged preliminary drainage, the defunctioned colon is often thickened and contracted, and it is sometimes difficult in constructing the anastomosis not to narrow the lumen to some extent. Open anastomosis and minimal suturing diminish this risk, but it may be necessary to resort to Cheatle's step of making a longitudinal incision at the antimesenteric border of one or both bowel ends to enlarge the lumen.

Extreme difficulty may be encountered in mobilizing the bowel when there is an unresolved abscess or when there is a vesico-colic fistula. It is probably wisest in the case of abscess to abandon the resection for the time being and to institute drainage; but a bladder fistula should be detached, the bladder carefully closed, and the resection proceeded with according to plan. Urinary drainage by an indwelling urethral catheter for seven to ten days is a wise supplement in such circumstances.

Pertinent to any discussion on the technique of operation for diverticulitis is the timing of elective resection in relation to the making of the colostomy. Colostomy as definitive treatment, in the hope that deflection of the fæcal content would lead to regression of the disease and allow later closure of the stoma, so often fails that it should not be considered. Indeed, a colostomy intended as a prelude to radical extirpation is very often disappointing in so far as the temporary and immediate relief of symptoms is concerned. Peridiverticulitis with recurring left iliac pain often persists; a vesico-colic fistula may still develop, and an established communication usually fails to heal; while many patients remain toxic and unwell.

Occasionally, in the elderly, it may be permissible or obligatory to rest content with a permanent colostomy; but in the majority of cases resection is advisable. I believe that in the past we have tended to delay this too long. Certainly, if the patient is well, is maintaining weight, and local guarding and tenderness have subsided, or if cystitis is relieved, a few weeks is a long enough interval between the colostomy and the resection. A longer interval may perhaps be appropriate if the colostomy was determined by perforation with peritonitis or by a large pericolic abscess; but I can see no advantage in delaying resection for more than three months, and it should be carried out sooner if tedious and incapacitating symptoms persist.

Ulcerative Colitis

The technical problems of surgery in ulcerative colitis are many. In recent years they have been often and thoroughly reviewed, but there are one or two observations to make. Removal of the colon is generally easy, and extensive removal of mesentery is unnecessary. It is wise to resect the omentum along with the transverse colon, however; if left, it may adhere to the small intestine, and later cause obstruction.

Like most, I have favoured total colectomy and excision of the rectum, initially in stages but latterly at a single sitting; but two recent experiences have provided food for thought. In the first patient the disease was limited to the region of the hepatic flexure and the proximal transverse colon, and resection of this segment in continuity with a carcinoma of the splenic flexure appears to have been satisfactory. Such circumscribed forms of ulcerative colitis are perhaps rare. On the other hand, the disease is often localized when the patient first comes under observation, and though total colectomy

and ileostomy are usually imperative at the stage at which most come to operation at present, it is even now not uncommon to remove a colon which is quite unaffected, or comparatively so, in its proximal part. Can we yet be quite certain that early and active surgical attack on the early lesion say, the sigmoid or descending colon, is not worth a trial?

The second experience was of the extraordinary healing which can occur in the rectum even in a severe case with many relapses. In this particular patient a primary one-stage procto-colectomy was carried out; but examination of the bowel afterwards disclosed a rectum which had substantially recovered. It would have been possible—and perhaps justifiable—to have made an ileo-rectal anastomosis, and I believe we should at least keep this possibility in mind.

In the past, perhaps the most difficult of the problems of surgery in ulcerative colitis has been, not the details of operation, but its timing and extent in relation to the stage and the severity of the disease. Two pre-operative measures may go some way towards resolving this—the use of *cortisone*, and of *amino-acids*, which can each effect a striking improvement in the patient's general state.

Cortisone, when effective, has a remarkable and rapid effect on the clinical course of the disease; diarrhœa is arrested, or vastly improved, hæmorrhage stops, and the patient gains in weight. Improvements begin within a few days, and may go on to complete remission, especially in the first attack. The results of the recently concluded Medical Research Council trial have yet to be made public; but it is now known that some 95% of patients in their first attack show marked improvement or pass into remission, as against 40% on the usual medical regime; and of relapsed cases, nearly 70% respond as compared with 53% of those treated without cortisone.

To date our own experience has been gratifying. Indeed, the use of cortisone has made possible single-stage proctocolectomy in patients who could not otherwise have been submitted to the extensive procedure, or indeed to any kind of operative treatment.

There have been reports from the United States of untoward effects, such as perforation and massive hæmorrhage from simultaneous peptic ulceration, and peritonitis from perforation of the colon. So far we have been spared these particular complications, and there has been no cause to alter the opinion that cortisone should be used as a pre-operative preparation in all seriously ill, and certainly all fulminating, cases of the disease.

The administration of cortisone may induce secondary suppression of the patient's own adrenal function, however; and in consequence the maintenance of post-operative fluid and electrolyte balance may be difficult if the drug has been stopped some time before operation, or is discontinued immediately afterwards.

Experience of surgery for other conditions in patients on cortisone therapy has shown that the duration of the therapy has little or no relation to the type or degree of stress response, and that the minimal interval after which operation is safe without special precautions is extremely variable. For these reasons, it is probably wiser to institute a prophylactic programme and administer cortisone 200 mg. intramuscularly forty-eight, twenty-four, and two hours before operation, and to continue with 200 mg. daily for three to four days before gradually tailing off. Obviously all patients who have had cortisone therapy must be very carefully observed during the post-operative period; there is considerable danger in the over-liberal administration of fluid, and in the use of morphine and its derivatives. Availability of intravenous cortisone will go far to allay anxiety on the scores of sudden adrenal insufficiency; but, at the moment, it is well to remember that intravenous nor-adrenalin by drip is valuable if an unexpected crisis arises.

Amino-acid preparations are somewhat out of fashion at the moment, but they can be very helpful in ulcerative colitis. In severe cases, the protein loss in the bowel discharges can be overwhelming, and there is a very considerable negative nitrogen balance. Intensive use of amino-acid infusions may minimize or occasionally reverse the loss of weight. Unfortunately they are not always well tolerated; that, and trouble with the veins, and the absence of spectacular and instant improvement, are possibly responsible for some of the lack of enthusiasm for them, and for early abandonment of the therapy. Nevertheless, it is worth an extended trial—not in the form of an occasional bottle, but daily over a period of weeks.

Amino-acid infusions and cortisone in combination can promote a hopeless or a poor-risk patient into one in whom the hazards of operation are insignificant.

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JOINT MEETING No. 6

Section of Orthopædics with Section of Neurology

Chairman—H. L-C. WOOD, M.S., F.R.C.S.
(President of the Section of Orthopædics)

[*June* 19, 1954]

MEETING AT THE NATIONAL SPINAL INJURIES CENTRE, STOKE MANDEVILLE HOSPITAL, AYLESBURY

Statistical Survey on One Thousand Paraplegics

By L. GUTTMANN, O.B.E., M.D., M.R.C.P.

THIS meeting falls in the year of the tenth anniversary of the opening of the National Spinal Injuries Centre, and is naturally an opportunity for analysing all the results accomplished during this decade in dealing with the hitherto neglected problem of paraplegia.

The Unit was started on February 1, 1944, with one patient, as one of the many preparations for the opening of the Second Front in Normandy. A great number of casualties amongst Servicemen was anticipated, and it was, therefore, decided—mainly at the instigation of the late Brigadier George Riddoch (then Neurological Consultant to the British Army and himself an expert in the field of paraplegia from the First World War)—to set up a new spinal unit to deal with war casualties suffering from spinal cord injuries. Previous attempts had been made to do something more for paralysed ex-Servicemen than had been done in the First World War, but experience before the end of 1943 had shown that, apart from the fact that a considerable number of paraplegics were being treated in general wards, where they could not possibly receive that constant, meticulous care a paraplegic needs day and night, the results achieved in the existing spinal units were far from satisfactory. There did not appear, as yet, to be a definite plan or end in view for the rehabilitation of even the more fit patients. It is significant that, in all discussions on rehabilitation at this time, the subject of paraplegia was hardly mentioned. It was not generally recognized that, in order to prevent these spinal units from becoming merely, as hitherto, an accumulation of doomed cripples, the provision of certain fundamentals was indispensable:

(1) Adequate technical facilities for the specialized care and management of such long-term patients, including facilities for their domestic, social and industrial resettlement.

(2) Nursing and auxiliary staff sufficient in number to cope with the many details involved in the work and avoidance of the usual practice of changing the nursing staff from one department to another at short intervals.

(3) Daily supervision of such a unit by an experienced physician or surgeon, who was prepared not only to take full responsibility for the planning of the whole rehabilitation of the paraplegic but also to devote his full time to this work, to organize and supervise personally, the many details of treatment and, perhaps most important of all, to correlate the sometimes conflicting interests of the various medical and surgical specialities concerned with the management and care of paraplegics.

By the end of the war, the unit had increased to 80 beds, and the closing of the spinal units at Barnsley Hall, Basingstoke, Leatherhead, Llandrindod Wells, Ronkswood, and Winwick, as well as the extending of the Stoke Mandeville unit's facilities to an increasing number of civilian paraplegics, resulted in further enlargement of the unit to the largest spinal centre of its kind in the British Commonwealth and Europe, with a total, including accommodation for paraplegic children, of 150 beds. Gradually, facilities for vocational training and sport were provided by the authorities concerned and proved a tremendous help in the physical, psychological and social rehabilitation of paraplegics. In this connexion, it may be noted that sport was introduced from the start as one of the most essential methods of physical rehabilitation, with the underlying idea that the paraplegic would be enabled to become a sportsman in his own right in sports adjusted to his disability. This idea proved to be correct, and a sports movement for paralysed people was developed, which, in the last three years, has become international and is considered as the Olympiad of the Paralysed.

Since 1946, the former Ministry of Pensions have set up four auxiliary spinal units for ex-Servicemen

and civilians, affiliated to and medically guided by the Centre, to relieve the increasing pressure of demands on the Centre. In these units, paraplegics can continue medical treatment and rehabilitation, pending discharge to their own homes or to four permanent settlements, which have in recent years, been set up by the Red Cross. Two of the Auxiliary Units are available to ex-Servicemen only. In addition, there is the Duchess of Gloucester House (70 beds) for both ex-Servicemen and civilians, and Rookwood Hospital, Cardiff (25 beds), mainly for coal-miners. This uniform scheme of management of paraplegics has proved invaluable for achieving most gratifying results from both medical and social points of view and has formed a sound basis for creating the fundamental change in our ideas on the prognosis of paraplegics.

Statistics are, as a rule, dry reading, but, in an analysis of the work of an institution, they are essential for presenting the important facts:

Table I demonstrates the development and progress of this Centre since 1949 and shows the turnover of patients—i.e. admissions and discharges.

TABLE I.—ADMISSIONS

	1.4.49 to 31.3.50	1.4.50 to 31.3.51	1.4.51 to 31.3.52	1.4.52 to 31.3.53	1.4.53 to 31.3.54
New admissions	99	104	107	122	185
Readmission for routine check-up or specialized treatment	169	183	198	282	255
	268	287	305	404	440
Out-patients	—	22	63	198	184
Total	268	309	368	602	624
DISCHARGES					
Discharges	262	276	297	393	423
Home or settlements	207	190	206	308	344
Chaseley Convalescent Home	20	14	25	9	15
Star and Garter Home	13	10	5	10	15
Duchess of Gloucester House	18	55	56	53	40
Other institutions	4	7	5	13	9
Deaths	6	6	5	7	4
Total	268	282	302	400	427
Total turnover	536	591	670	1,002	1,051

Table II gives a survey of the segmental level, the type of lesion and the various ætiologies of the first thousand cases admitted up to the end of December 1953. These figures in Table II are in accordance with statistics of other authors and my own published previously elsewhere (Guttmann, 1947–53).

TABLE II.—TOTAL MATERIAL

		Injuries		Transverse myelitis	Polio-myelitis	Miscell-aneous	Total
Cervical	Complete	17	66	1		1	19
	Incomplete	49		8	25	23	105
Thoracic 1–5	Complete	57	74	4		6	68
	Incomplete	17		5	1	6	29
Thoracic 6–12	Complete	303	371	29	12	23	366
	Incomplete	68		22	22	46	158
Cauda equina	L. 1–5	199	239	2		7	208
	S. 1–5	40		2		5	47
		750		73	60	117	1,000

Injuries	75%
Transverse myelitis	7%
Poliomyelitis	6%
Miscellaneous	12%

Table III shows a detailed classification and relationship between Service and civilian injuries.

TABLE III.—TRAUMATIC LESIONS

		Service cases and pensioners		Civilians	
Cervical	Complete	11	44	6	22
	Incomplete	33		16	
Thoracic 1–5	Complete	43	53	14	21
	Incomplete	10		7	
Thoracic 6–12	Complete	191	244	112	127
	Incomplete	53		15	
Cauda equina	L. 1–5	148	183	49	56
	S. 1–5	35		7	
		524		226	
			750		

Classification of Service Cases and Pensioners

World War I	33
World War II	416
Period after World War II including injuries from Palestine, Malaya and Korea ..	75
	524

TYPE OF MATERIAL

Patients were admitted at varying intervals after injury or onset of disease and can be conveniently divided into the following groups:

(1) *Early admissions.*—During the later stages of World War II, spinal cord casualities were given high priority for repatriation by air—a decision which not only proved to be a life-saving measure but resulted in earlier rehabilitation of these unfortunate men to a useful life. Many arrived from the battle-front in serious conditions, some of them with gaping gunshot wounds discharging C.S.F. or with associated injuries to other organs (particularly lungs), or fractures of extremities and already with multiple sores. It was the seriousness of their condition and the helplessness of these young soldiers which played such an important part in creating the close doctor/patient relationship, on the one hand, and that fine teamwork of devoted men and women, on the other, which led to the development of the new unit into the National Spinal Injuries Centre as it stands to-day. It could be proved already in those early days that a man admitted twelve days after gunshot wound of the spine, with a complete transverse section of the cord below T.8, complicated by hæmothorax and sores over both buttocks, was able to be out of bed and in his wheel-chair ten weeks after his admission and six weeks later working at a bench in a factory. It could also be proved that bedsores even of gigantic dimensions could be healed without antibiotics or plastic operations in a relatively short time.

After the war, traumatic paraplegics following fracture of the spine were admitted in increasing numbers, either a few hours or a few days after injury. Again, this early admission to the Centre proved most beneficial to the patient, as all the complications, such as sores, urinary infection, contractures, &c., developing, as a rule, in hospitals where the paraplegic cannot receive that meticulous care, night and day, which he needs in the first period after paraplegia, could be avoided altogether and their rehabilitation to useful citizens infinitely hastened. It was proved that patients with complete paraplegia following fracture dislocation of the spine could be discharged from this Centre, fully readjusted to their permanent paraplegia and to a new scheme of life and ready to take up employment again, within six to twelve months after injury—and, in cases with incomplete lesion, even sooner. The sooner the paraplegic can be admitted to a spinal unit or hospital equipped with all necessary facilities the greater is his chance for speedy and complete rehabilitation.

(2) *Late admissions.*—The majority of paraplegics were admitted at later dates, following onset of paraplegia. They can be divided into several groups, according to the predominance of their clinical symptoms:

(*a*) Paraplegics admitted with signs of septic absorption resulting from urinary infection and pressure sores. Amongst these, there were patients with as many as thirteen sores and more, some of them penetrating into the hip, knee and ankle joints. Most of these patients, who also showed infection of various parts of their urinary tracts, especially those during the war and the early after-war period, had suprapubic cystostomy done as the early management of their paralysed bladders. Many of these patients showed signs of nutritional

deficiency and some a degree of malnutrition easily comparable with those found in inmates of concentration camps (Belsen type). However, even these cases could be restored to health and usefulness.

(*b*) Another group of late arrivals, where intractable spasticity and pain were the presenting clinical symptoms.

(*c*) A group of patients, where contractures of joints and muscles, apart from other symptoms, were the most disabling complications. These were patients, both cord and cauda equina lesions, where faulty position in the early stages of paraplegia and, in particular, immobilization in plaster casts and plaster beds, had caused these contractures.

(*d*) Special mention must also be made of a group of late arrivals, where the physical condition was not unsatisfactory but the mental state was very poor, due to prolonged and enforced inactivity at home or in hospitals and institutions, including spinal units, without adequate facilities for regular work and vocational training.

(3) *Readmission of former in-patients for review or specialized treatment.*—This group has gradually grown with the increasing number of paraplegics discharged from this Centre. As far as possible, a proper follow-up of former patients has been carried out, either as out-patients—and this applies especially in the case of those in employment—or as in-patients. This has proved extremely valuable, as it has been possible to discover and control deterioration of the patient, due to active infection of the urinary tract or other causes, in good time, and thus maintain his working capacity, and also to follow up their domestic and social readjustment and industrial resettlement.

It is obvious that the great variety of symptoms observed in all these groups involve many problems of physiology, biochemistry, medicine, surgery, and social science. This makes the subject of spinal paraplegia one of the most fascinating in medicine, and the activities of those concerned with the treatment and rehabilitation of paraplegics have to be multifarious. Moreover, a good deal of clinical and physiological research has been carried out in the Centre, since its inception in 1944. Amongst the problems tackled, the following may be mentioned: reflex activity of the isolated cord, control of posture in the spinal man, effects of visceral activity on the autonomic system, with special reference to the cardiovascular system, thermoregulatory and reflex sweating, studies on the muscular system with special reference to compensatory training, evaluation of methods in the management and re-education of the paralysed bladder, studies on the sexual function in paraplegics, studies on the ætiology of pressure sores, and evaluation of various methods in their treatment. With the opening of our own biochemical laboratory, under Mr. R. Robinson, the scope of research on such problems, as protein and calcium metabolism, has greatly increased.

Teaching to graduates and postgraduates of the medical, nursing and physiotherapy professions from this country and abroad has played a very important part in the activities of the Centre, throughout the years, and national and international societies have held their scientific meetings here.

Table IV shows the death-rate on the total material of one thousand cases, as compared with that of traumatic paraplegics. The latter are divided into Service cases of World War II, including the after-war period, and civilians.

TABLE IV.—MORTALITY

A. *Total material*—1,000 cases	
83 deaths out of 1,000	= 8·3%
62 (corrected figure) out of 1,000 ..	= 6·2%
B. *Traumatics*	
(1) *Service cases and pensioners* (excluding World War I):	
49 deaths out of 491	= 10%
39 (corrected figure) out of 491 ..	= 7·9%
(2) *Civilians*	
8 deaths out of 226 cases	= 3·6%
4 (corrected figure) out of 226 cases	= 1·8%

*After deducting those cases where death was due to causes other than their spinal paraplegia.

In considering mortality from paraplegia it is of particular interest that the great majority of the 367 survivors of the 416 casualties of World War II have already lived for nine to fourteen years following their injury. The death-rate, due to spinal paraplegia, of these war casualties is still under 10%, after many years, which shows the dramatic change which has taken place in the prognosis of traumatic paraplegics, as compared with the mortality rate of the First World War, when it was about 80% already during the first few years after injury.

DOMESTIC AND INDUSTRIAL RESETTLEMENT

Considering the high survival rate of spinal paraplegics, as the result of the great advance made in their treatment and management, during the last ten years, it is clear that the importance of the problem of paraplegia, in its social implications, is growing from year to year. Only a few years ago, the spinal paraplegic was, as a rule, still condemned as unemployable, unproductive and socially useless. To-day, this defeatist attitude is no longer justified, in view of the experience gained in recent years, regarding the employability of paraplegics.

774 out of the 1,000 cases have been discharged from the Centre. 591 returned to their own homes, after these had been adjusted to their disability, and were able to live in their old environments with their families—an achievement which no doubt represents the ideal type of domestic resettlement of paraplegics. 183 live either singly or with their families in permanent settlements. 22 of these 774 paraplegics were too old to work. 518 (69%) of the remaining 752 were employed, the majority of them (405 or 78%) full time, including full-time workers in factories. The number of employed is probably even higher, as some of the 18 cases which we were unable to contact at the time of making the statistics and which were therefore included in the number of unemployed will doubtless be in employment. Many more of the remaining 224 paraplegics are, of course, employable, had more facilities for employment been available at the time of compiling the statistics (December 1953).

From all our experience, it can now be concluded that the percentage of paraplegics unemployable on account of their spinal cord lesions will be extremely small, provided society is able to accept them. "Life is worth living now!" These words, quoted from a letter from a former patient of this Centre, are the conclusion of the many men and women who have made a full readjustment to a new life by returning to productive activity and employment, in spite of such a serious physical handicap, and, of all the results achieved in the rehabilitation of the spinal man, during the last decade, this is the most gratifying of all.

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Initial Treatment of Traumatic Paraplegia

By L. GUTTMANN, O.B.E., M.D., M.R.C.P.

THE purpose of this paper is not to describe all the details of initial treatment of traumatic paraplegia, following closed injuries to the spine, but to deal with those two important aspects, (A), the management of the fractured spine, and (B), the management of the paralysed bladder.

(A) MANAGEMENT OF THE FRACTURED SPINE

It is a well-established fact that the degree of vertebral deformity resulting from fractures and fracture dislocation of the spine is not in itself the crucial factor for the establishment of excellent functional results. Although it is desirable in fracture dislocation of the spine involving the spinal cord and its roots to bring the displaced vertebræ into the best possible alignment, hasty and forced manipulative procedures in the initial stage should be avoided, as they may cause irreparable damage to the cord or its roots, which, at the time of injury, suffered only slight damage by mere concussion or partial contusion. Moreover, it has been established, in this Centre and by other workers in this field, that considerable if not perfect recovery of the cord or caudia equina may occur, in the presence of bone displacement, without immobilization of the paralysed patients in plaster casts or plaster beds.

The routine procedure in this Centre, in dealing with traumatic paraplegics following fracture and fracture dislocations, in the initial stage, is as follows: The patient is placed on sorbo packs, with two or three additional pillows underneath the fracture, to produce hyperextension in the physiological position, as much as possible, and to restore the normal curvature. From the basic, supine position, the patient is turned first on to one side, then back to supine position, then on to the other side, every two hours, day and night. The turning is carried out by three or four orderlies, working under the direction of the medical officer, the sister or the trained nurse in charge, who are made fully aware of the details of the fracture and their responsibility in each individual case. Care is taken that the patient be turned in one piece.

Plaster casts and plaster beds are deprecated in this Centre for external fixation, as, in all cases admitted here with this form of external fixation, pressure sores were always present. It has been proved again and again, in the last ten years, that the conception that plaster beds will prevent or heal pressure sores in traumatic paraplegia by distributing pressure more evenly is incorrect. In fact, this method of nursing paraplegic patients not only failed to prevent sores but actually promoted the development of sores of the most frightful type. Therefore, this type of external fixation has been denounced by me from the beginning, when it was the accepted procedure for the treatment of traumatic paraplegia, and, in due course, more and more workers in this field came to the same conclusion. Recently, Holdsworth and Hardy (1953) confirmed the disastrous effect of external fixation with plaster beds in 16 cases.

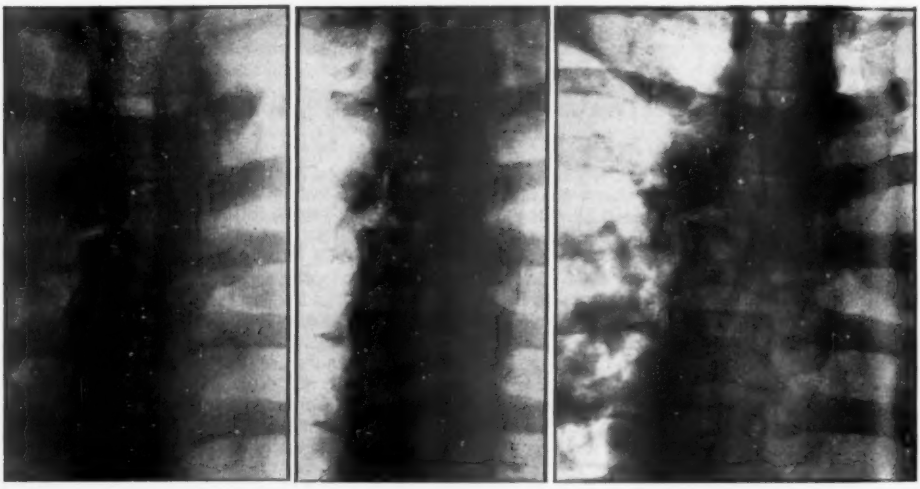
With the method of immobilization of the paraplegics on pillow or sorbo packs, with regular turning as described above, the development of pressure sores has become unknown, and in cases admitted with sores already developed, healing has taken place in a very short time.

Recovery of the cord has been found, even in fracture dislocation with marked bone displacement of the mid-thoracic spine, where the spinal canal, unlike its anatomical arrangement in the cervical and lumbar region, is narrow. The following case-history is typical of this method.

Case I.—C. G., a married woman, aged 28, was involved in a motor-car accident on 27.2.54. She was admitted to this Centre next day and showed severe fracture dislocation of T.5/6, with marked lateral displacement. T.6 vertebra appeared to be completely crushed (Fig. 1, A–C). On the day of injury, she had an almost complete paraplegia, with the exception of the left great toe, which could be moved slightly. Knee and ankle jerks were found to be absent. Plantar response was flexor. There was complete analgesia below T.7 and retention of urine.

On the day of admission, the patient was already able to move the right leg slightly and there was also minimal function of the iliopsoas and adductors and a flicker of the quadriceps on the left side. Knee-jerks (+), ankle-jerks (—). Plantar response was flexor but became extensor on the fifth day after injury. The patient was placed on sorbo packs with two pillows underneath the fracture and two-hourly turnings, day and night, were carried out. Initial treatment of the bladder was by intermittent urethral catheterization. By 9.3.54 she had made rapid improvement of the motor function, as well as partial recovery of sensibility. Bladder and bowel function had also returned.

She began to sit up twelve weeks after injury and is now able to walk short distances without any artificial aid whatsoever. Motor power in all muscles of the legs is perfect. Knee and ankle jerks are exaggerated and there is an extensor plantar response. There are only patches of analgesia between T.7 and T.12. Postural sensibility is normal, even for finest movements. Fig. 1, B and C show the X-ray findings in later stages, the last X-ray showing callus formation of the displaced vertebræ. Many other similar cases might be quoted if time allowed.



A (2.3.54). B (2.4.54). C (9.6.54).

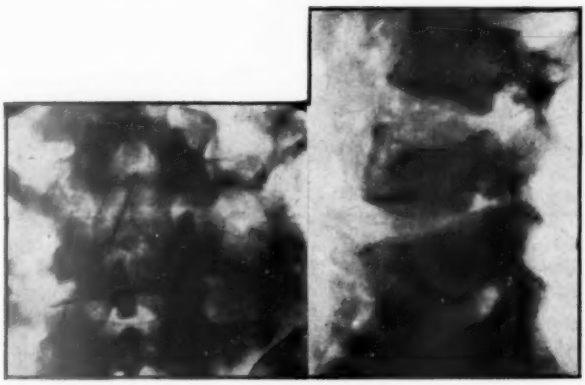
FIG. 1, A–C (*Case I*).—Fracture dislocation of the 5th thoracic vertebra with marked lateral dislocation followed by severe, though incomplete, transverse spinal syndrome below T.5, with excellent functional recovery following closed method of immobilization.

The same regime of initial treatment is also employed in fractures and fracture-dislocation of the thoraco-lumbar spine, and even very unstable fractures can become stabilized by this type of immobilization as shown in a case of fracture-dislocation of the 4th lumbar vertebra:

Case II.—A man aged 33, who was hit by a cement mixer on 23.4.54. The first X-ray (Fig. 2A) revealed a severe fracture of the 4th lumbar vertebra, apart from multiple fractures of the transverse processes of L.1 to L.4 on the right side. The lateral third of the 4th lumbar vertebra was broken off and there was an associated fracture of the pedicle (Fig. 2B), making the whole vertebra extremely unstable.

On admission on 24.4.54, there was marked weakness of both lower limbs. Knee-jerks, ankle-jerks and plantar response were absent on both sides, and there was sensory impairment below L.3 on both sides, especially S.1, with analgesia in S.3 to S.5. There was retention of urine and fæces. He was nursed on sorbo packs, producing good hyperextension of the lumbar spine, with regular turnings every two hours. The bladder was treated with intermittent catheterization and the urine remained sterile for three weeks, after which it became slightly infected on three occasions but is now sterile again. Four days after admission, the motor symptoms increased and gradually all dorsi- and plantar flexors of the toes and feet became paralysed. However, there was no change in sensory disturbance and, therefore, surgical interference was decided against and conservative treatment continued, as it was felt that the increased symptoms were probably due to œdema or hæmorrhage affecting the anterior roots only. Since 12.5.54, the motor function in the toe and foot muscles on the right has gradually returned, followed by return of function of the plantar flexors of the toes and foot and extensor digitorum and peronei on the left side. The bladder control gradually returned, and intermittent catheterization

A (23.4.54). B (26.4.54).



C D
(14.6.54.)

FIG. 2, A–D (*Case II*).—Most unstable fracture dislocation of L.4, accompanied by multiple fractures of transverse spinous processes. B shows fracture of pedicles. C and D demonstrate very satisfactory reduction and fixation achieved by closed method of immobilization. Excellent functional recovery of cauda equina lesion.

was discontinued. The X-rays of 14.6.54 (Fig. 2, C–D) showed excellent alignment and callus formation—in particular, the fractured pedicles of the 4th lumbar vertebra had become fixed again. At present, all muscles of the right leg, foot and toes are perfect; on the left side, there is good function of gastrocnemius, flexor hallucis, flexor digitorum, and extensor hallucis longus. Sensibility has also greatly improved, and there is analgesia only in the three distal sacral segments. He is able to micturate by straining. Rectal function is normal. Erections are present.

POSTSCRIPT (13.11.54).—This man has been discharged home six and a half months after his injury, ready to start work and able to walk without support of any kind.

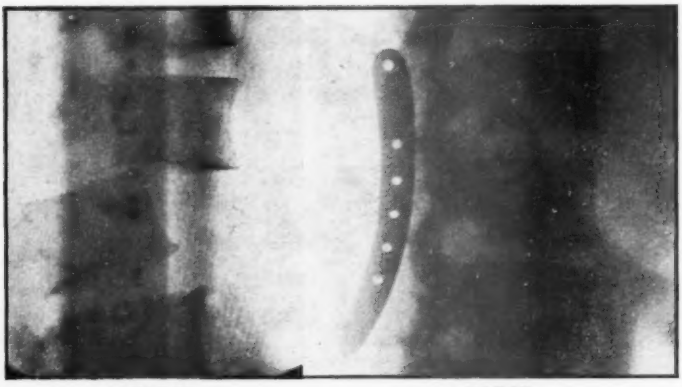
OPEN REDUCTION AND INTERNAL FIXATION BY PLATING

Although open reduction of fracture-dislocation of the spine had already been recommended by F. Albee in 1940 and J. Taylor in 1941, most surgeons during the war adopted non-operative reduction

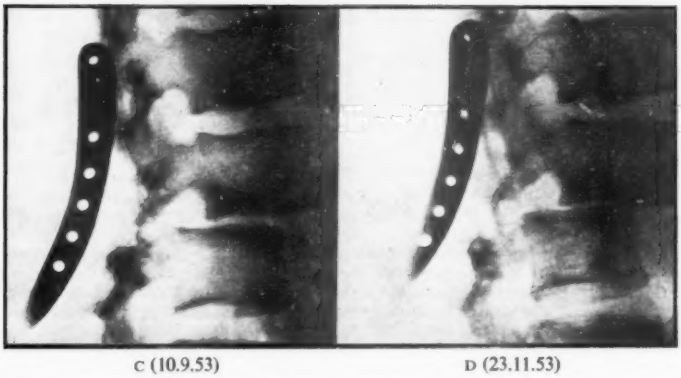
of fracture dislocation by manipulation, followed by immobilization in plaster casts or plaster beds. However, recently the open reduction has been revived by Holdsworth and Hardy (1953) who condemn manipulative reduction as being usually unsafe and advocate, in paraplegics with fracture-dislocation of the thoraco-lumbar spine, internal fixation by bolting two metal plates through one or more spinous processes above and below the level of the dislocation. They describe this method as simple, safe and effective. Pennybacker (1953) suggests as likely that this kind of internal fixation will prevent progressive angulation and other deformities, when the upright posture and weight-bearing are resumed, and Dick (1953) says that the spine can be stabilized in this way so securely that ordinary nursing handling is "absolutely safe and there is no danger of further damage to recovering nerve roots".

Of the 25 patients who, in recent years, were admitted to this Centre, following open reduction of their fractures and fracture-dislocations, there were 21 in whom the method of internal fixation by metal plating had been used by various workers, as the initial management. This considerable material calls for a review of the results achieved, which is discussed in the light of the claims made by the advocates of this method:

(1) *Simplicity of method.*—On anatomical grounds it is apparent that plating may be difficult if one or several spinous processes are broken, and that secure fixation must involve using plates extending over at least four vertebræ, with the associated interference with the stabilizing erector spinæ muscles. Holdsworth and Hardy themselves admit difficulties and point out that "the surgeon has to exercise ingenuity in fixing the plates to the laminæ".



A (10.7.53) B (16.7.53)



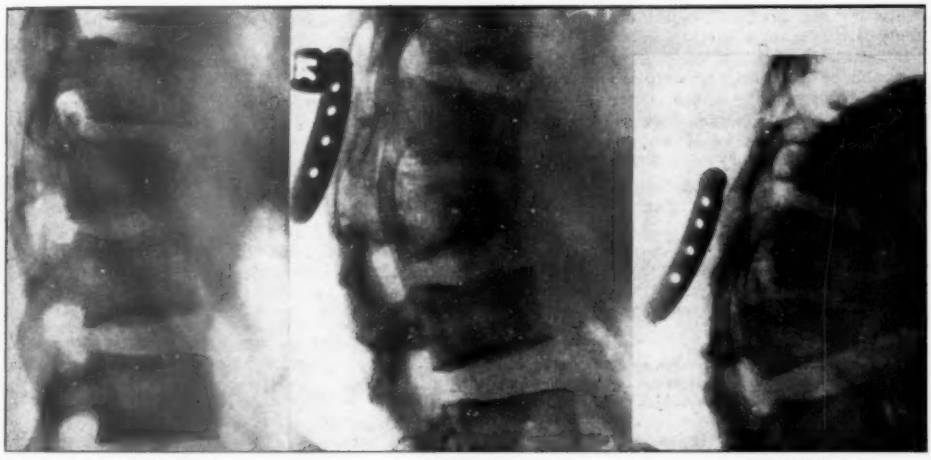
C (10.9.53) D (23.11.53)

FIG. 3, A–D.—Fracture dislocation of L.2 with severe backwards dislocation. Open reduction and internal fixation by plating, with perfect result at first but redislocation a few days later. C and D show later stages. Plate had to be removed because of great discomfort and danger of breaking through the skin.

(2) *Prevention of redislocation.*—Fig. 3, A–D show that, while the reduction of the dislocated vertebra was at first perfect, a redislocation was not prevented by the internal fixation. Fig. 3, C and D show

the redislocation at later dates. In fact, the plates had to be removed, after patient's admission to the Centre, as they were driven backwards, by the redislocated vertebra, underneath the skin and were not only producing discomfort and pain but there was the danger of their breaking through the skin. Another patient developed, after the removal of the plate, a meningitis, from which he fortunately recovered. He was admitted to this Centre with a large wound in the back, which took many weeks to heal and resulted in damage to the back muscles, thus delaying rehabilitation.

(3) *Prevention of progressive angulation.*—One will readily understand, from a purely mechanical point of view, that if the broken vertebra is fixed to its neighbour by wire or short plates only progressive angulation cannot be prevented. Fig. 4A illustrates a case of fracture dislocation of L.1. Open reduction was carried out elsewhere, one day after injury, 4A, and the spine was fixed by two Wilson plates (size 1) and two bolts. Seventeen days later, patient developed pulmonary embolus but recovered. He was admitted to the Centre on 19.5.54, with complete transverse spinal syndrome below T.11. He complained of severe pain in back and was unwilling to carry out activities because of pain and stiffness. Since removal of plates, pain has subsided and patient has made excellent rehabilitation. The complete transverse syndrome is unchanged. Figs. 4B and C show redislocation and increased angulation.



A (2.3.54) B (5.4.54) C (20.5.54)

FIG. 4, A–C.—Fracture dislocation of T.12/L.1. Slight backwards dislocation. Open reduction and plating with only short plates. Redislocation and increased angulation not prevented by procedure. Complete transverse spinal syndrome unchanged.

(4) *Safety of method.*—All these cases, to which more could be added, may suffice to disprove the assumption that internal fixation by plating is a safe method for the stabilization of the fractured spine—particularly if "ordinary nursing handling", as emphasized by Dick, is employed. I consider it very hazardous to dispense, after internal fixation, with that meticulous caution and care which is so imperative in the management of a paraplegic patient, following fracture or fracture-dislocation of the spine, described above for the nursing of paraplegic patients without open reduction and plating.

(5) *Efficiency of the method in promoting recovery of the cord or roots and in preventing further damage.*—From the literature, as well as from our own observations made on paraplegics admitted to the Centre after open reduction and plating, there is no proof that this method is in any way superior to other methods of reduction and immobilization. In at least one case of fracture-dislocation of L.2 of our material, it is quite evident, from the previous medical notes, that the clinical symptoms definitely increased in intensity, following surgical intervention.

From all these observations, one is forced to the conclusion that the method of open reduction, followed by internal fixation by metal plating, does not represent a satisfactory initial treatment in stabilizing the fractured spine with cord or cauda equina involvement and that, as far as the experience gained in this Centre is concerned, the claims made by the advocates of this method cannot be confirmed. Not only is this method quite unnecessary in the initial treatment in the great majority of fracture dislocations, but it actually has disadvantages over the closed method of reduction followed by careful immobilization. The open reduction in traumatic paraplegics, followed by internal fixation by plating or bone grafts, has its indication, if at all, only in the most excessive types of fracture dislocation, especially those with profound lateral displacement.

(B) Management of the Paralysed Bladder

In previous publications (Guttmann, 1947, 1949*a*, *b*, and 1953), I have drawn attention to the undesirability of suprapubic cystostomy either in the initial treatment, or in the permanent management of the paralysed bladder. In fact, from all experience gained in this Centre on the 704 traumatic paraplegics, where bladder drainage was necessary, as well as that gained from other workers in this field, it can now be concluded that the routine performance of suprapubic cystostomy in injuries of the spinal cord and cauda equina is contra-indicated. In particular, it may be noted that the contention held dogmatically during World War II that, in front-line conditions, proper urethral catheterization is impossible is no longer valid, in view of the experience gained in the Malayan and Korean campaigns. It has been shown by both British and American Army Medical Officers that, even under the most adverse battle conditions prevailing in Malaya and Korea, a proper urethral catheterization could be carried out. It is gratifying to note, from a statistical survey made on 704 traumatic paraplegics with bladder involvement admitted to the Centre in the last ten years that a remarkable change has taken place in the conception of the initial treatment of the bladder, and there is now a marked decrease in the number of suprapubic cystostomies in both the Service cases from the after-war period and civilians, as compared with cases from World War II. Moreover, it is also evident that suprapubic drainage is discontinued much earlier, as compared with the cases from World War II, where the state of the bladder and the urinary tract following suprapubic cystostomy and the general condition of many patients on admission were not sufficiently satisfactory to allow the early closure so desirable, if only from a psychological point of view. For, to most paraplegics, the suprapubic tube is repugnant, and one of our patients who had had his suprapubic drainage for as long as ten and a half years insisted on having it discontinued, once urethral micturition had been established. It is our experience that the sooner suprapubic drainage is discontinued the better the prospect of restoring a good capacity and satisfactory control of the bladder and of checking urinary infection and preventing late ureteric and renal changes. Moreover, in cases in which suprapubic drainage has been continued for long periods, healing of the suprapubic wound is always delayed, and, even if the track has been excised surgically, it still has the tendency to break down. Although we have succeeded in discontinuing suprapubic drainage in some cases with long-standing suprapubic drainage, such good results are the exception rather than the rule, as in most long-standing cases the bladder has become contracted and fibrotic and the valve mechanism of the ureteric orifices has become defective.

The procedure practised and developed in this Centre as initial treatment of the paralysed bladder is as follows:

(1) *Stage of non-interference by instrumentation.*—We found that, as a rule, the paralysed bladder is never so distended as to warrant immediate drainage by any method. Moreover, it may be noted that, during the first few days following spinal cord injuries, the rate of renal secretion may be retarded. Usually, sixteen to twenty-four hours will be quite safe, and in cases with retarded renal secretion, longer periods may be allowed. During this period of non-interference by instrumentation, repeated attempts by gentle manual pressure upon the bladder region, combined with digital massage *per rectum*, is carried out to overcome the retention and elicit voiding. The fear that, in this stage, rupture of the bladder may occur by manual expression of the urine has proved to be unfounded.

(2) *Stage of bladder drainage by intermittent or continuous urethral catheterization.*—If voluntary or reflex micturition has not developed within twenty-four hours or longer, drainage of the bladder is indicated. This is carried out under scrupulous aseptic precautions, using the non-touch technique (Guttmann, 1949a). At first, intermittent catheterization is employed every eight to twelve hours, according to fluid intake and the rate of renal secretion of the patient, and a Foley catheter, size 16F, is used in adults. The reason for first using intermittent catheterization and not indwelling catheter is to allow the urethral mucosa to become gradually accustomed to the foreign body. It must be remembered that, in the stage of spinal shock and flaccidity, all tissues, including the urethral mucosa, have lost their tone and the threshold to pressure is lowered. Therefore, any indwelling catheter, especially one of larger size, left in the urethra for any length of time in the initial stages after spinal injury may produce a pressure sore in the posterior urethra, with severe infection and fistula formation at the penile-scrotal junction. With incomplete lesions, where early return of bladder function can be expected, intermittent catheterization allows distension of the bladder, which is a strong stimulus for promoting early return of bladder activity. The patient is kept from the start under an umbrella of small doses of sulphatriad and terramycin or aureomycin. It has been proved in this Centre again and again that, by this method, the urine can remain sterile for many weeks, by which time, in cord lesions, the automatic bladder may return.

However, infection does sometimes occur with any form of artificial drainage and if it cannot be checked an indwelling catheter, with either daily bladder washouts, as recommended by Kidd in 1919, or with tidal drainage, as recommended by Munro (1935), is the method of choice. The best type of indwelling catheter is the self-retaining Foley catheter size 16F with 5 c.c. balloon. It cannot be emphasized too strongly that, at first, the indwelling catheter should be changed every other day and later on at intervals of two to three days. In order to free the urethra from deposits, it should be washed out either with flavazole 1/2,000, or with local chloromycetin before inserting the new in-

dwelling catheter. Such washouts are especially necessary when urethritis has developed. Once the automatic function of the bladder has returned, the indwelling catheter should be removed and intermittent catheterization instituted and continued until detrusor action is powerful enough to empty the bladder or leave only a small residual urine. The same principle applies to cauda equina lesions, when voluntary micturition becomes possible by pressure on the abdominal wall. Frequent residual urine tests are essential during the early stages of bladder re-education. This regime has been found to be satisfactory in the management of the bladder in paraplegic patients and has prevented serious complications in most of our cases.

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Dr. A. G. Hardy: It was very disappointing to see such bad results of internal fixation by plates. These are quite the opposite of our experiences in Sheffield, to which Dr. Guttmann has referred. Some comments could, perhaps, be usefully made. First, the selection of cases: Some appeared to be simple crush fractures which did not require fixation anyway. In others the plates were too short and only held in position by a pair of nuts and bolts. In others only single plates were used. These latter features would all tend to produce poor fixation and could only be attributed to bad technique.

If plates are to be used at all they should be double and placed one on either side of the spinous processes of the vertebræ. They should be attached by three or four sets of nuts and bolts to the spines of adjacent vertebræ either two above and one below the fracture site or vice versa.

Open reduction and internal fixation has not been used as the routine procedure for every case at Sheffield. Indeed it has only been performed on 19 out of 47 cases of fractures at the thoracolumbar junction although a further 11 were explored and internal fixation not considered necessary.

All the operative wounds healed by first intention with the spine in good alignment. None later developed secondary angulation and only one had to have the plates removed and only then at a time when bony union was firmly established.

In these cases subject to operation the early relief from pain and the ease of handling were very striking when compared with a similar group of early cases who had not been immobilized in anyway whatsoever. The nursing and turning of both groups of cases was carried out in the same orderly manner. Internal fixation was not an indication for less precision in nursing methods but it certainly facilitated the ease of nursing in the early stages.

Four of our patients developed recovery of root function which had not been previously anticipated and whereas this may not be statistically significant we feel that the restoration of the normal alignment of the spinal canal might have assisted recovery by relief of compression on trapped roots.

On three occasions pieces of bone and disc material were removed from the spinal canal although subsequently there was no alteration in the neurological signs noted in these cases.

Mr. Walpole Lewin (Oxford); In the management of the paraplegic patient in the Korean War as compared with the Second World War the most striking advance was the use of the Stryker frame for early treatment and transport for cases returning to this country. These patients had arrived home in excellent condition. Once the early stages were past, however, treatment on an ordinary bed was preferred as this gave the patient greater freedom and allowed more efficient re-education of the shoulder and back muscles. Another feature was the use of tidal drainage with an indwelling urethral catheter in preference to suprapubic cystotomy.

Serum Protein Changes Following Spinal Cord Injuries

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PREVIOUS studies carried out at this centre by Dr. Guttmann (1945, 1953) showed that the total protein concentration was almost always normal or only slightly diminished, even in those patients of the "Belsen" type. However, on fractionation it was found that the albumin/globulin ratio was invariably inverted, i.e. the total globulin concentration was higher than the albumin concentration. It was also observed that the inversion of the albumin/globulin ratio may be present in the very first days following injury.

During the last few years we have collected a large amount of data on serum protein values in the later stages of paraplegia, and it became desirable that a study should be made of the serum protein changes occurring in the early stages after injury with special reference to the following questions:

(1) How soon after the spinal injury do the serum protein changes occur?

(2) In what form is the protein lost?

(3) Is there any marked change in any particular protein fraction, i.e. any change peculiar to spinal cord or cauda equina injuries?

(4) What effects do blood transfusions have on the serum protein changes?

Material and Methods

We have studied 6 cases (4M and 2F) of spinal injury with involvement of the cord or cauda equina from whom it was possible to get specimens of blood at intervals of from seventeen hours to three days after their injuries. 4 of the 6 were cauda equina lesions, one was an incomplete cord lesion below T.11, and the sixth was a mid-thoracic lesion incomplete below T.5. All our patients were young, healthy individuals: 5 of the 6 were in the age range 21 to 35 years and one was aged 42 years. There was no reason to suppose that any of these patients had an abnormal serum protein pattern before the injury.

The method employed in our study was that of zone electrophoresis on filter paper and an apparatus of the Flynn and de Mayo (1951) type was used.

We examined sera from our patients at frequent intervals (every other day at the beginning) and the total proteins, alpha, beta, and gamma globulins were determined. In addition, twenty-four-hour specimens of urine were collected and examined for their nitrogen and protein content.

Results

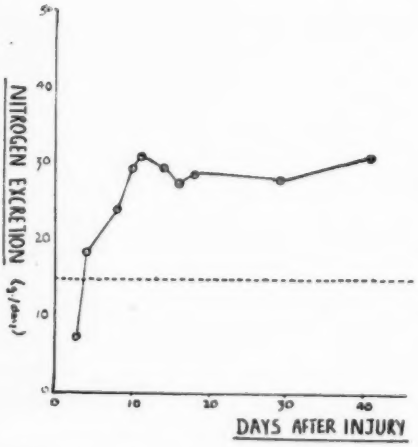

FIG. 1 (*Case I*).—Urinary nitrogen excretions.

Case I.—H., a man of 35 years with a cauda equina lesion complete below L.3 following fracture-dislocation of L.1 sustained on 19.4.54. On admission on 20.4.54, there were no hæmatomata visible. There was a rapid loss of albumin and an increase in the alpha fraction (Fig. 2). The effect of blood transfusion is shown: an increase in the total proteins, a decrease in the alpha globulins and an abrupt halt to the loss of serum albumin. Blood transfusions always have a marked effect and it has been shown by Guttmann (1945, 1946, 1949) and Walsh (1952) in this Centre and other workers in this field that frequent blood transfusions are the most efficacious method of combating nutritional deficiency in paraplegics.

Fig. 2 also shows another feature we have distinguished, namely a slow rise and fall in the gamma globulin fraction, which usually reaches its peak between twenty and thirty days after the injury.

The period when the serum proteins are dropping rapidly corresponds with the period when the urinary nitrogen excretion is increasing most rapidly. This is shown in Fig. 1.

None of our patients showed increased urinary protein values: their bladders were never allowed to become infected.

Case II.—C. G., a woman aged 28 years, sustained a spinal cord lesion incomplete below T.5 following a severe fracture-dislocation of T.6 on 27.2.54. Multiple hæmatomata were found over face and both legs on admission to this Centre on 1.3.54. It is worthy of note that this patient, who only showed a slight increase in the alpha globulin fraction (Fig. 3), and who is the only patient in our series who did not show any loss of total protein, is the patient who had the most incomplete lesion in our series of cases and who subsequently made the most complete recovery of motor power. There was only slight residual sensory loss to pain and temperature sensibility.

The urinary nitrogen excretions were high in this case but so too were the urinary volumes. They were frequently almost 5 litres and there is some evidence (Peters and van Slyke, 1946) that urinary volume has some effect on nitrogen excretion.

In analysing our findings, we observed as outstanding features in injuries to the spinal cord and cauda equina the preferential loss of serum albumin over the other fractions, and a gradual increase in the gamma globulin fraction. In 4 of our 6 cases there was, too, a marked increase in alpha globulin in the early stages after the injury.

This finding of increased alpha globulin is in accordance with the observations of Perlmann *et al.* (1943), Chanutin and Gjessing (1946), Shedlovsky and Scudder (1942) and other workers, who have found increased alpha globulins in head injuries, fractures of limbs and burns in both animals and human beings. Keyser (1952) considered that this increase is due, at least in part, to increased serum-protein bound carbohydrates. Seibert *et al.* (1947, 1948) have suggested that increased serum polysaccharide is associated with tissue destruction. This is consistent with the increased urinary nitrogen excretion shown by all our patients, the source of the nitrogen being catabolized protein. The converse, however, is not necessarily true since 2 of our patients showed increased urinary nitrogen excretion with little increase in the alpha globulin fraction.

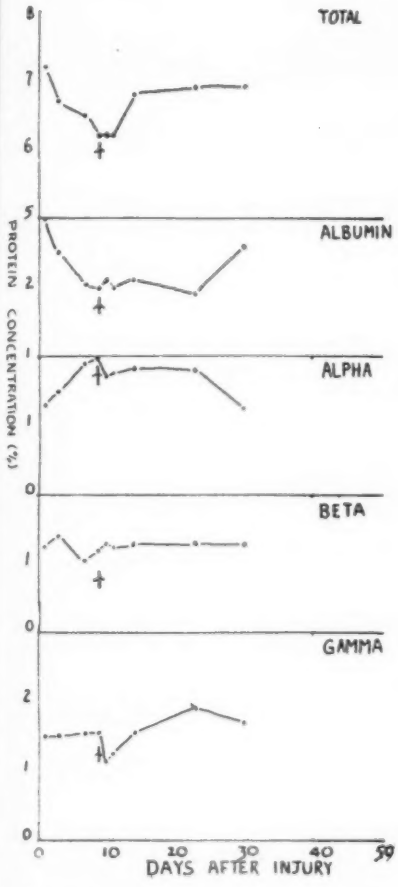

FIG. 2 (*Case I*).—Serum protein changes. The small arrows indicate the point when a blood transfusion was given. Note the increase in the gamma globulin fraction.

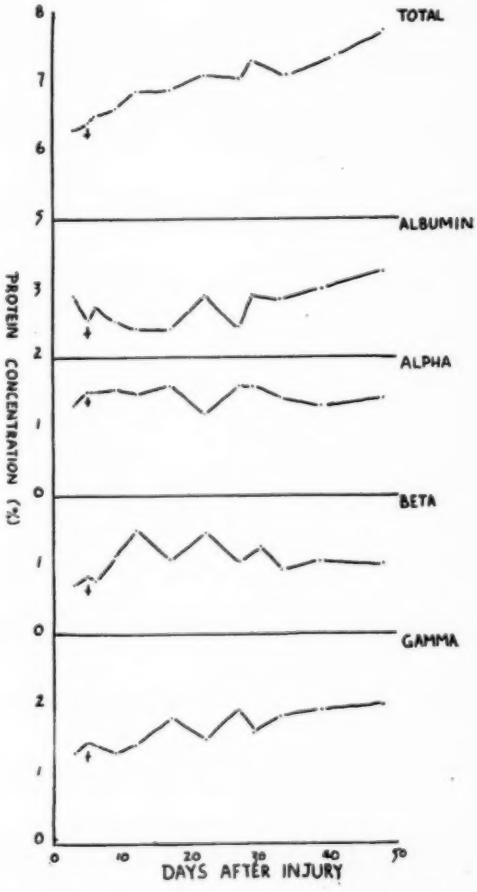

FIG. 3 (*Case II*).—Serum protein changes. Note that there was no fall in the total protein concentration in this case.

If we postulate the release of some proteolytic substance immediately or very shortly after the injury, we can account for the preferential loss of albumin over the other fractions and the gradual increase in the gamma fraction. The rate of loss of the various fractions will then obey the Law of Mass Action, i.e. the rate of loss of any particular fraction will be proportional to its molar concentration. Now, the molar concentration $= \frac{\text{Concentration in grams per litre}}{\text{molecular weight}}$ and, since albumin is

present in a higher concentration in terms of grams per litre than any other fraction and since its molecular weight is far smaller than that of any other fraction, then its molar concentration is by far the highest. Consequently, its rate of loss is by far the highest. On the other hand, the gamma fraction, which is normally present in a concentration of only about 1% has the highest molecular weight, and, therefore, the lowest molar concentration. Its rate of loss is thus the lowest. Since there is a plasma volume loss which averages about 14% there is an apparent increase in the gamma fraction. There are doubtless other influences at work which tend to increase the gamma globulin concentration even farther. It must be remembered that the gamma fraction is the one which contains antibodies, and we have frequently found that patients admitted to this centre with infected pressure sores have increased gamma fractions. Cases with active infection of the urinary tract also show an increase in this fraction.

Serum Proteins in the Later Stages of Paraplegia

Once the serum protein changes just described have taken place, paraplegics rarely show normal values of the albumin/globulin ratio again.

Figs. 4 and 5 show the results of an analysis of serum protein determinations on 100 cases in the later stages of spinal paraplegia. In this series the fractionation was carried out with 26% sodium sulphate (Martin and Morris, 1949).

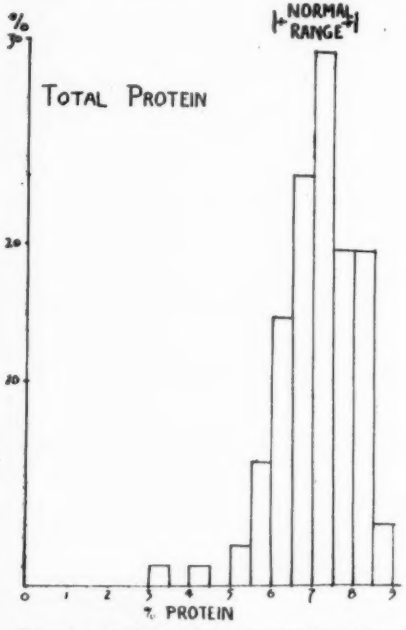

Fig. 4.—Analysis of serum protein determinations on 100 patients. Ordinate, percentage of cases; abscissa, total protein concentration.

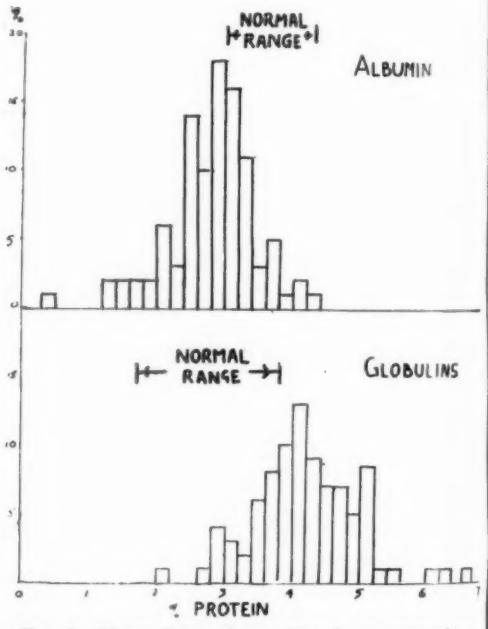

Fig. 5.—Upper figure shows albumin concentration; lower figure total globulin concentrations. Ordinate, percentage of cases; abscissa, protein concentration.

Fig. 4 shows that the total protein concentration usually falls between the normal limits of 6 to 8% with a slightly higher proportion falling above that range than below it. The distribution has a slight negative skew and the median value is 7·25%.

Fig. 5 clearly illustrates that the albumin values are on the whole lower than the globulin values. In this series only 3 cases were found with albumin/globulin ratios greater than unity. These were all fit men free from urinary infection and pressure sores. We have, nevertheless, found many similarly fit men with albumin/globulin ratios less than 1. The upper portion of Fig. 5 shows that the major proportion of the albumin results fell below the normal range of 3 to 4·3%, the median value being 2·9%. The lower part of Fig. 5 shows that the major proportion of the globulin results fell above the normal range of 1·7 to 3·8%, the median value being 4·1%.

Summary

(1) Following injury to the spinal cord and cauda equina, there is a rapid change in serum protein values.

The features of this change are:

(*a*) a rapid fall in serum albumin concentration,

(*b*) an increase in the alpha globulin concentration in the early days following injury, and,

(*c*) a much slower rise and fall in the gamma globulin concentration.

(2) The rate of fall of the albumin concentration suggests very strongly that these changes start within a very short time after the occurrence of the injury.

(3) The increased protein catabolism leads to an increase in the excretion of nitrogenous metabolites in the urine.

(4) Following the injury, as far as the albumin/globulin ratio is concerned, the serum proteins rarely attain normal values again.

(5) Blood transfusion has a profound effect on the changing serum protein values after the injury and is the most efficacious method of preventing malnutrition.

Acknowledgment

My thanks are due to Dr. L. Guttmann for his help throughout this investigation.

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Electromyographic Studies on Posture in Paraplegics

By J. Melzak, M.D., and F. D. Stott, M.A., D.Phil.

Introduction

It has been shown by Guttmann (1951) that although postural sensation, like all other forms of sensation, is abolished following complete lesion of the spinal cord in man, it is possible to exercise control of posture in the paralysed parts of the body, and to maintain equilibrium in the erect position. This is achieved by the use of certain muscles, in particular the latissimus dorsi, which have their segmental innervation in the spinal cord above the level of the lesion, and their points of insertion in the paralysed part of the body, particularly the pelvis.

An account was then given of some investigations carried out by electromyography on 6 paraplegics and 2 normal subjects, with a view to throwing some light on the problem of the part played by the various normal and paralysed muscles in maintaining posture in spinal man.

Apparatus and Technique

All the investigations described here were carried out with apparatus specially constructed in the Electro-Medical Research Unit for this type of work.

Material and Examination Procedure

To date, 6 paralysed patients with complete lesions of the spinal cord, and 2 normal subjects have been examined in detail. In all these paraplegic patients, the complete transverse spinal syndrome was of traumatic origin, due either to gunshot injury or fracture dislocation of the spine; in 1 case, it was the result of operative removal of a spinal cyst. The level of the lesions varied between T.2 and L.1. The motor paralysis was of spastic type of varying intensities in 5 cases, while in 1 case with paraplegia below L.1 the lesion was of lower motor neurone type, with flaccid paralysis as far as the hip flexors, glutei and flexors of the knees were concerned. The knee-jerks in this case were absent. The time lapse since the onset of the spinal paraplegia varied between five and ten years. All paraplegics examined were fully rehabilitated and in excellent physical condition. The examination has been concentrated on four muscle groups, the latissimus dorsi, gluteus maximus, quadriceps and hamstrings.

The normal procedure has been to apply electrodes to the muscles while the patient was sitting between parallel bars, and then to record the activity

(i) during rising to the erect position with the aid of parallel bars, the patient supporting himself with both hands and keeping the forearms in extension,

(ii) while remaining erect and balanced,

(iii) while changing from an erect to a relaxed leaning forward position on the bars,

(iv) while sitting down from the erect position.

(v) Recordings have also been made on some of the patients during adduction of the arm against resistance while lying in a lateral position.

Results of Examination on Patients

These results are based on the study of several hundred feet of records so far taken; the short lengths reproduced here are given as examples only.

Case I.—W. H., male, aged 52. Transverse spinal cord syndrome below T.12 with spastic paraplegia after compression fracture of T.12–L.1 vertebræ on 19.8.49.

Results of electromyographic examination.—Vigorous activity in quadriceps, hamstrings, and some in gluteus maximus while standing up. Quadriceps activity somewhat reduced once fully erect position is attained. Hamstring activity does not reach a maximum until the fully erect position is attained (Fig. 1).

Tendency to develop clonus while standing.

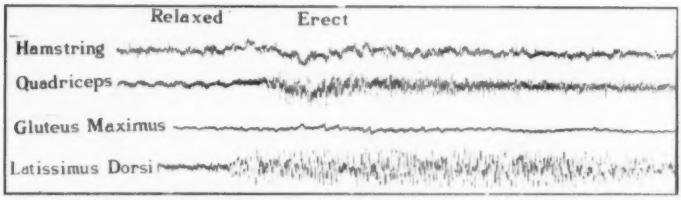

FIG. 1 (*Case I*).—Spastic paraplegia. Illustrating vigorous reflex activity in quadriceps and hamstrings.

Case II.—H. R., male, aged 28. Transverse spinal cord syndrome complete below T.3 with spastic paraplegia following gunshot wound on 28.6.44. Extensor spasm.

Results of electromyographic examination.—Vigorous activity in quadriceps during standing up and sitting down. Vigorous activity in both quadriceps and hamstrings while standing erect. The activity in the hamstrings did not start until the erect position was reached, whereas that in the quadriceps was maximal during rising and sitting down. There was a strong tendency to develop clonus in the quadriceps after standing erect for about half a minute (Fig. 2).

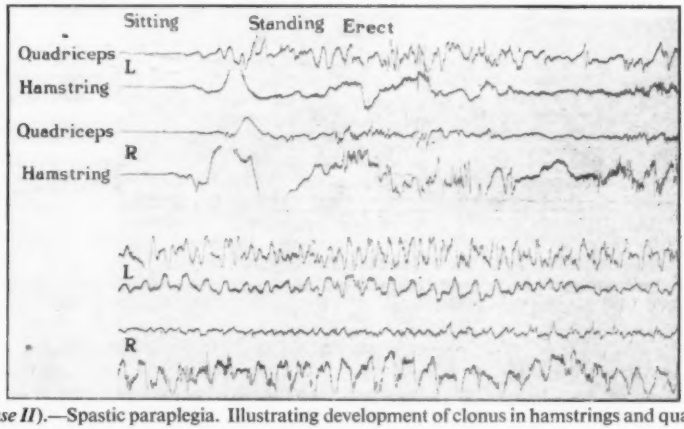

FIG. 2 (*Case II*).—Spastic paraplegia. Illustrating development of clonus in hamstrings and quadriceps.

Case III.—S. D., male, aged 36. Complete transverse spinal cord syndrome below T.6 with spastic paraplegia, following removal of spinal cord cyst in 1939.

Results of electromyographic examination.—During the act of standing up and sitting down, bursts of activity were seen in the hamstrings and quadriceps but no measurable activity was found in the gluteus maximus. In contrast to Case I, there was little continuous activity in quadriceps and hamstrings while remaining erect (Fig. 3).

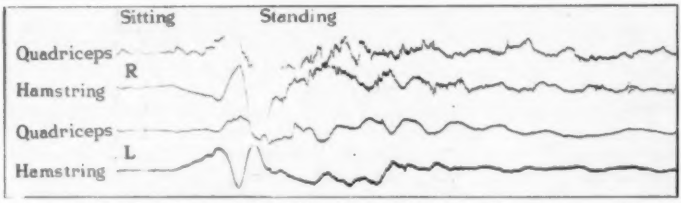

FIG. 3 (*Case III*).—Spastic paraplegia. Illustrating activity in hamstrings and quadriceps while rising to standing position.

Case IV.—P. A., male, aged 46. Complete transverse spinal cord syndrome below L.1 after fracture dislocation of T.12 vertebra with complete paraplegia on 9.8.47. The paralysis of glutei, hip flexors, quadriceps and hamstrings was of lower motor neurone type.

Results of electromyographic examination.—Vigorous activity of latissimus dorsi during rising from sitting to erect position. No activity was found in any of the paralysed muscles examined, either during standing up and sitting down, or while remaining erect (Fig. 4).

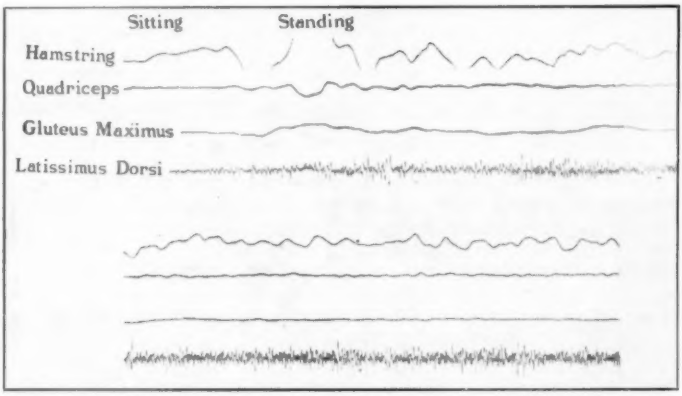

FIG. 4 (*Case IV*).—Flaccid paraplegia. Showing absence of any reflex activity in paralysed muscles while rising and standing erect, but vigorous activity in the latissimus dorsi.

COMMENTS AND CONCLUSIONS

The common feature found in all the paraplegic patients examined—5 of them with spastic paraplegia and 1 with flaccid paralysis of the hip and thigh muscles—was the vigorous activity of the latissimus dorsi during the act of rising from sitting position and the maintenance of posture in standing position. This finding confirms Guttmann's views about the importance of this muscle in the restoration and control of posture in erect position, especially standing, in paraplegic patients. Comparison with healthy subjects shows that, in normal conditions, the latissimus dorsi plays only a small part, as compared with the gluteus maximus, during the act of rising from the sitting to the erect position, even if the person uses his arms to raise the body from the sitting to the standing position.

Interesting differences were found in the relationship between the voluntary function of the latissimus dorsi and the reflex function of the paralysed gluteus maximus, quadriceps and hamstrings, in the spastic cases. When the patient was lying in lateral position, even vigorous adduction of the arm against resistance, producing powerful contractures of the latissimus dorsi with upwards tilting of the pelvis, did not elicit any action potentials in these paralysed muscles.

However, during the act of rising from the sitting position, voluntary contraction of the latissimus dorsi was invariably followed by action potentials in these paralysed muscles. It appears, therefore, that a stretch reflex is elicited, resulting in reflex contractions in gluteus maximus, quadriceps and hamstrings in the spastic paraplegic, when the legs are made to carry some of the patient's weight. As one would expect, no signs of reflex activity were observed in the one patient in which these muscles showed a flaccid type of paralysis.

The reflex activity during the act of rising was particularly intensive in quadriceps and hamstrings,

while it was found to vary in intensity in the gluteus maximus, in different patients. It is possible that the difference in thickness of the fat layer in the buttocks is responsible for the variable recording from the gluteus maximus.

During the act of rising, there was vigorous activity in quadriceps and, once the erect position was attained, also in the hamstrings. In the erect position, the activity in the quadriceps tended to decrease, while the hamstrings remained active all the time. In Cases I and II, there was a tendency for clonus to develop, usually starting in the hamstrings and spreading to the quadriceps. This also happened occasionally after relaxing. On the other hand, in Case III, once the erect position was attained, the pattern of activity in the hamstrings was found more similar to that of these muscles in the normal controls. This more co-ordinated reflex response in these two cases is an interesting finding, as it may prove, if confirmed on a greater material, to what extent of co-ordinated function the isolated cord in the spinal man may be trained.

Acknowledgments

The authors wish to acknowledge the guidance and encouragement given by Dr. Guttmann and and Dr. R. B. Bourdillon, and the technical assistance of Mr. E. H. Pitte, Mr. F. E. Bew, and Mr. R. Strads in the photographic work involved, and in the construction and maintenance of the apparatus.

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Surgical Aspects in the Treatment of Pressure Sores

By J. J. Walsh, M.B., B.Ch., B.A.O.

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The purpose of this paper is to describe briefly a few points of surgical interest, which in our experience have proved to be of particular importance in the treatment of pressure sores in paraplegic patients.

Any pressure sore can be healed by conservative methods including, where necessary, excision of necrosed tissues, and in practice the great majority of sores treated at this centre are healed by such methods. However, we have found that there are two main indications for surgical repair:

(1) *Repeated breakdown of a healed scar.*—This is, perhaps, the more common and may arise soon after the patient first gets out of bed and make his return to a useful life impossible. On the other hand quite often adherent scars, as a result of healed sores over sacrum, ischii and trochanters give no trouble for several years.

(2) *To shorten the period of healing.*—This is especially applicable (*a*) in sinus sores occurring as a rule over the ischial or trochanteric regions where a small skin defect leads into a large cavity in the deep tissues and (*b*) in extensive superficial sores. In the latter type we have found that seed grafts buried in the granulation tissues, as recommended by Bors and Commar (1948) of California, form the most satisfactory method of promoting rapid healing.

Time of Operation

An important point is the correct timing of the operation. In our experience poor results are common when reparative surgery is carried out within a few weeks of acute local infection, in the presence of several sores or where the patient's general condition is not satisfactory. For this reason and also because of the increased tendency to vasomotor upsets following operation at an early stage we have found it best to postpone surgery until the patient is really fit. We have also found it especially important to exclude any infection with hæmolytic streptococcus, *Staph. pyogenes*, *Ps. pyocyaneas*, and Proteus.

Local Preparations

Many paraplegics, especially those who have been submitted to prolonged pressure by recumbency in plaster casts or particularly plaster beds, develop a curious and often very marked loss of elasticity in the tissues around a scar and in these cases pre-operative treatment by grease massage is of the greatest value in facilitating closure of the wound.

One other point in the pre-operative preparation concerns the positioning of the patient. In most cases the post-operative period will be spent partly or entirely in the prone position and where necessary, especially in a spastic case, it is an advantage to accustom the patient to the position during the days before operation.

Technique

It has been our experience that three points of surgical technique are of particular importance in paraplegic patients. The first concerns local preparation. Unfortunately many cases have required prolonged treatment with a large number of medicaments and some have developed an allergy to one or more of the drugs used, common examples being the flavine group, antibiotics and iodine. Whilst the usual type of reaction is mainly a local one with mild general features, much more serious and indeed often alarming generalized reactions do occur particularly in high lesions. Such reactions include giant œdema, tachycardia, cyanosis and collapse and care is, therefore, necessary in the selection of local applications.

Another point which we have found to be of the greatest importance is the necessity for meticulous hæmostasis. Many patients tend to continue oozing or bleeding for several days after operation and unless hæmostasis is very thorough indeed, hæmatoma formation may render a repair unsuccessful. In this connexion we have found that paraplegics are susceptible to post-operative anæmia even where the blood loss on the table has been very moderate and consequently we give blood transfusions either during or after any of the more extensive operations. We have found no contra-indication to electro-coagulation as a method of hæmostasis.

The third point concerns the type of suture material. We have found that catgut is particularly unsuitable for the majority of cases in whom both plain and chromic catgut continued to be discharged with the formation of stitch abscesses for weeks and even months after operation. Silk and thread sutures were a little more satisfactory but these again frequently caused the same trouble as catgut. Stainless steel wire has proved most satisfactory and we now use it routinely in all operations, with an occasional thread tie for larger vessels in inaccessible positions.

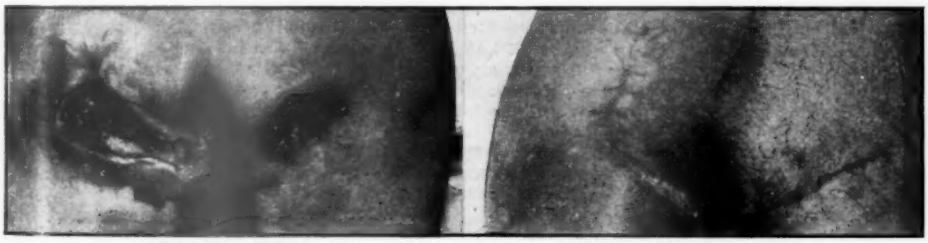
The sores and scars which most often require surgical repair are those over the tuber ischium, the femoral trochanter and the sacrum in that order of frequency.

Sinus Sores

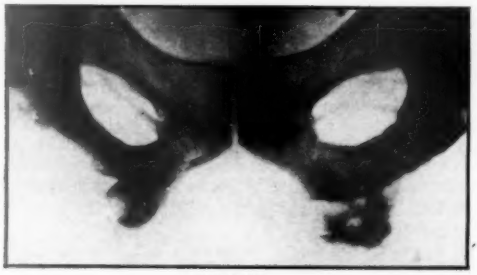
I would like now to discuss in some detail what we have found to be one of the most common and the most dangerous of pressure sores—the so-called sinus sore.

This variety occurs most often over the ischial tuberosity and the femoral trochanter and the visible skin lesion is as a rule small and innocent in appearance. This is liable to mislead the inexperienced into overlooking the progressive destruction which occurs in the deeper tissues of the underlying cavity.

In sores over the tuber ischium whether sinus type or larger the infection spreads first to the underlying tuberosity and ischio-pubic ramus (Fig. 1, A, B, C) and in neglected cases it is not unusual to find



A (28.2.52). Before. C (8.9.52). After operation.



B (28.2.52).

FIG. 1.—Ischial sores showing severe osteomyelitis of ischial bone extending toward hip-joint on left. Bone less affected on right—reactive calcification.

that a complete segment of the ramus has been destroyed. From the bone further extension often occurs in one of three directions.

(*a*) Along the ischium to the hip-joint perhaps to produce a septic arthritis. We have admitted several cases with extensive joint destruction following such sores (Fig. 2).

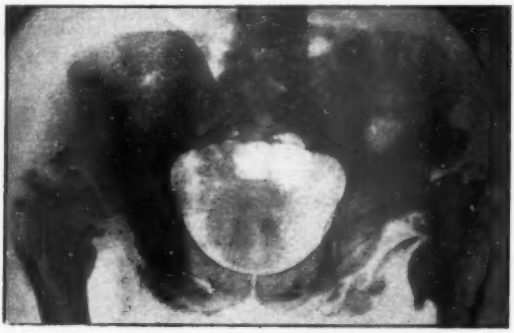


FIG. 2.—Bilateral destruction of hip-joint following ischial sores.

(*b*) Down along the posterior fascial compartments of the thigh sometimes as far as the knee, resulting in perforation through the popliteal fossa.

(*c*) Forwards into the region of the groin. This last direction of spread appears to be associated with prolonged continuous nursing in the prone position.

Over the great trochanter many of the lesions are of the sinus sore type and frequently the whole outer surface of the trochanter forms one wall of the cavity.

X-ray examination following lipiodol injection has proved invaluable for the accurate diagnosis of the extent and direction of the sore. Our experience of such sores led us to practise very thorough excision during their repair, but the dissection was usually difficult and tedious and quite frequently accidental openings were made into the cavity.

I have found it a great advantage to adopt the method introduced and described by Dr. Guttmann as pseudo-tumour technique (1950). This consists of tightly packing the relatively large and often branching cavity with narrow ribbon gauze soaked in a brightly coloured antiseptic. The narrow skin sinus is then closed with one or two sutures and through an elliptical incision the whole mass is dissected out of the surrounding healthy tissues like a tumour. The dissection is thus made much easier, contamination of the operation field is avoided, and if one does approach the inner part of the wall the yellow colour of the flavine usually gives warning before actual penetration of the cavity has occurred.

The X-ray appearance of the bone, particularly in ischial and trochanteric sores can be very misleading. It has been our experience that the results are much better when a substantial part of the underlying bone is removed.

In the ischial sores it is not unusual to excise a large part of the tuberosity together with almost the whole ischio-pubic ramus *en bloc* with the scar tissue. Where a good deal of the deep tissues has been removed and especially in thin patients it is an advantage to swing a flap of gluteus maximus downwards and inwards over the tuber ischium to fill up dead space and also to provide a cushion between the bone and the overlying skin.

Calcification of adjacent soft tissues particularly muscles is a common finding in both ischial and trochanteric sores and as it occasionally progresses to a point where mechanical interference with joint movement results, I usually remove such calcified tissues if they present during operation.

TROCHANTERIC

In the trochanteric area closure of the wound after excision of a large sore can be difficult, particularly if the shape and size of the scar did not permit the incision to run obliquely downwards and forwards. Removal of the greater part of the trochanter gets rid of prominent and possibly potentially infected bone and also facilitates closure.

There is usually a large defect in the deep tissues and not uncommonly only skin and superficial tissues can be approximated often after "easing" both ends of the incision to give an S-shaped suture line. However, in our experience the results of such a closure are satisfactory although occasionally a short course of grease massage, given several weeks after operation is required to mobilize an adherent scar.

I must confess to frequently offending against one of the rules of plastic surgery by closing wounds under a good deal of tension but I have found the results, perhaps surprisingly, are satisfactory and certainly preferable to leaving a defect to be filled by some form of free graft. It is, however, of the utmost importance to put in several layers of deep sutures including a line of fine wire sutures immediately under the skin. This is particularly necessary in spastic cases where the suture line will be subjected to repeated strains throughout the period of healing. Also, firm healing is sometimes delayed so that the scar line, apparently sound, tends to part as late as two or three weeks after operation. The subcutaneous sutures help to prevent this.

Post-operative Care

We have found that careful supervision of the post-operative treatment is of the utmost importance. Following repair of ischial and trochanteric sores we do not permit flexion of the hip for three weeks, after which time passive flexion is gradually increased to a right angle and only then is the patient allowed out of bed, as a rule four to five weeks after operation. At this stage, regardless of how satisfactory the repair has been, it is essential to explain to the patient the dangers of prolonged pressure and to make him sore-conscious.

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Arthroplasty of the Knee for Ankylosis in Extension in Paraplegic Patients

By L. S. Michaelis, M.D.

When a patient is fit enough to start life in a wheelchair, ankylosis in extension of one or both knees becomes a serious handicap. With the foot sticking out in front, he can neither reach door handles, turn in a narrow passage, nor sit close to a workbench.

Operative mobilization of synostoses and ankyloses was necessary and considered justified, in spite of the risks incurred in surgery on paralysed limbs. Their precarious blood supply ruled out the use of a tourniquet during the operation, and of plaster-casts and skeletal traction afterwards. Hæmostasis had to rely on diathermy alone, since neither catgut, silk nor bone-wax are well tolerated by devitalized tissue. Bleeding is both profuse and diffuse in such tissue, but has to be controlled, since a hæmatoma of any size means recalcification and failure of the arthroplasty. The patients had vulnerable scars from old sores both over the sacrum and near the ankylosed joints. They had to be turned two-hourly during the weeks after the operation. But only light, thickly padded splints and 4 lb. of skin-traction could be relied on for keeping the leg in alignment. Both splints and traction had to be removed daily, the skin examined and splint and traction replaced, if new pressure sores were to be avoided.

In our first patient no anæsthetic was needed. In the other two, reconstruction of the joint required long general anæsthetics which are tolerated only if given by an expert.

Case I.—A 36-year-old miner suffered a fracture-dislocation and complete transverse cord-lesion below T.12 with flaccid paraplegia in 1944.

He was treated locally in a plaster-bed extending from shoulders to ankles, for four years and three months.

On admission here in 1950 he had a severe urinary infection, fibrous ankyloses of the hips and knees, synostoses of the patellæ with the femur and bony ankyloses of the ankles.

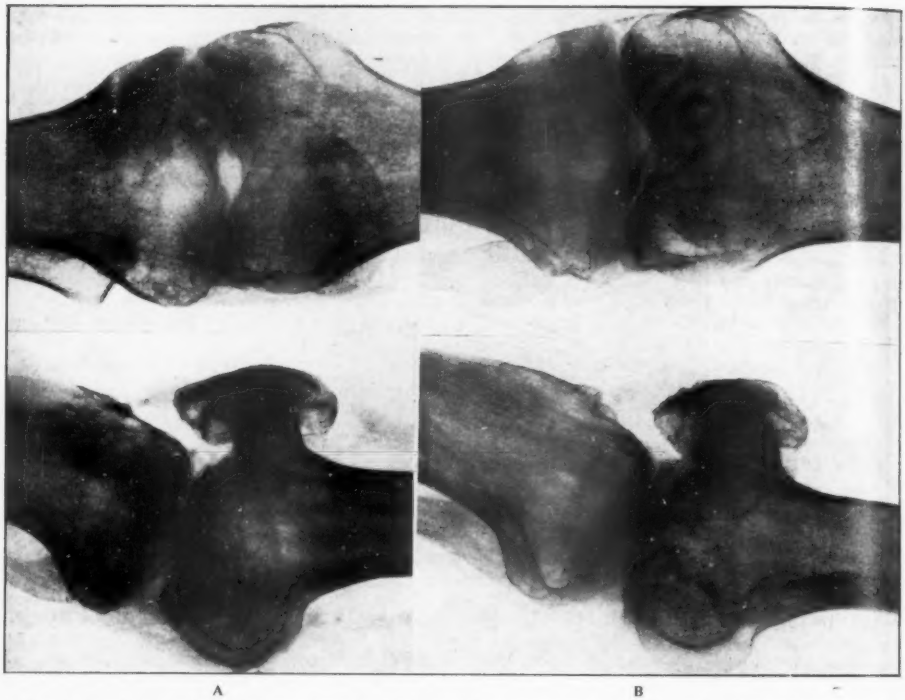
Tissue-paper scars from pressure sores covered sacrum, trochanters, patellæ, condyles of femur and tibia, the subcutaneous surfaces of the tibiæ and the ankles. Both knees were fixed in hyperextension (Fig. 1A, B).

At operation it was difficult to find a stretch of skin through which to make the incision. Excision of the patella would have led to a large skin-defect in front of the joint.

A superficial slice of the knee-cap was therefore left attached to the scar in the overlying skin. The synostosis was excised. The patellar ligament was detached from the tuberosity and slung between the raw surfaces of the patellar remnant and the front of the femur (Fig. 2A, B).

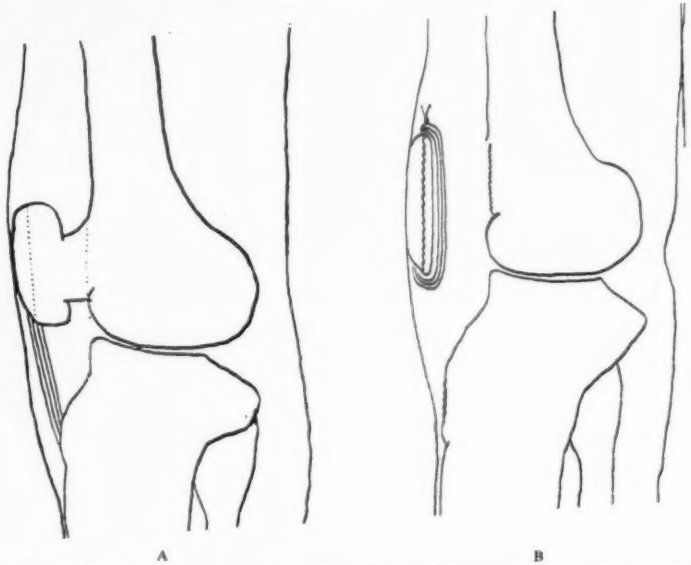
On the left side broad calcifications fixed the gliding part of the collateral ligament to the lateral condyles. Only after they were removed, could a flexion range of 50 degrees be obtained. Further flexion was on both sides prevented by adherent scars. Since physiotherapy had mobilized the hips to 70 degrees and 90 degrees flexion respectively, the patient could now sit in a chair, with his feet resting on the foot-rest.

When seen three years after the operation, flexion in both knees was reduced, on the left owing to partial recalcification, but he still claimed that he was much more comfortable and still reached the foot-rest.



A B

FIG. 1 (*Case I*).—Bilateral fibrous ankylosis of knee in hyperextension, with patello-femoral synostosis.



A B

FIG. 2 (*Case I*).—Subtotal excision of the patella. The patellar ligament is detached from the tibial tuberosity, turned up to lie between the new raw bone-surfaces, and sutured to the proximal pole of the patellar remnant.

Case II.—A 46-year-old builder sustained a fracture of the first lumbar vertebra with a cauda-equina lesion, incomplete, below L.1, in 1948. He was treated in a plaster-bed and had a suprapubic cystostomy. Two months later he had a large sacral sore and severe urinary infection.

After a further six months a sore near the right knee penetrated into the joint. A septic arthritis left him with a fibrous ankylosis in extension, lateral instability and severe pain.

On admission here he was in an appalling condition of anæmia and sepsis. One year later his sores were healed, the cystostomy closed and the patient up in a chair. Now the knee became a painful disability.

An arthroplasty was carried out following the design published by Hass of Vienna, first in 1925, later in 1944 (Hass, J., 1944, *J. Bone Jt. Surg.*, **26**, 297).

The femoral joint-surface is shaped like a wedge, the tibial slightly hollowed. Hass used fat- or fascia-lining for his new joint. I used no interposing material of any kind, relying on the fibrin from clot to provide in time the new fibro-cartilage. The tibial tuberosity was temporarily detached for better exposure. The epicondyles and collateral ligaments remained.

Pain was much reduced, flexion of 70 degrees resulted (Fig. 3), and the foot could comfortably be placed on the foot-rest. Six months after the operation the patient was permitted to stand and walk with calipers.

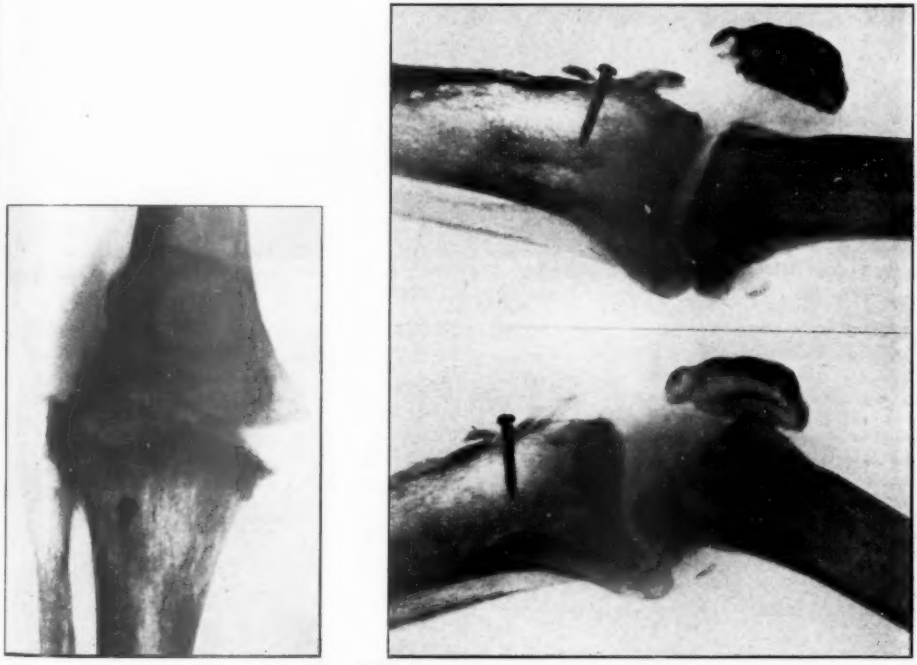


FIG. 3 (*Case II*).—Right knee, four months after operation.

Case III.—A 15-year-old girl was involved in a motorcycle accident in June 1946. She sustained a fracture-dislocation with complete spastic paraplegia below T.6.

For sixteen months she was treated in another hospital, then nursed for nine months at home.

In July 1948 she was admitted here, emaciated, with 13 pressure-sores and a stone in the right kidney. In October 1948 the sores were healed. In November the stone was removed. During the next two years unsafe scars were excised and repaired.

The right knee showed a bony ankylosis after septic arthritis starting from a sore.

In February 1950 an arthroplasty of the excision type was done by another surgeon. The attempt at mobilization failed.

In March 1951 the attempt was repeated, but a post-operative hæmatoma collected behind the joint and ankylosis recurred (Fig. 4).

The patient, a gifted artist, found the extended leg a great hindrance and urged us to try again. Now a large bony mass surrounded the great vessels.

The operation was planned to begin with a removal of the calcified hæmatoma from a posterior approach followed by an excision of the patellar synostosis as in the first, and Hass arthroplasty as in the second patient.

A flexion-range of 90 degrees was obtained and has happily been maintained so far, nine months later (Fig. 5).

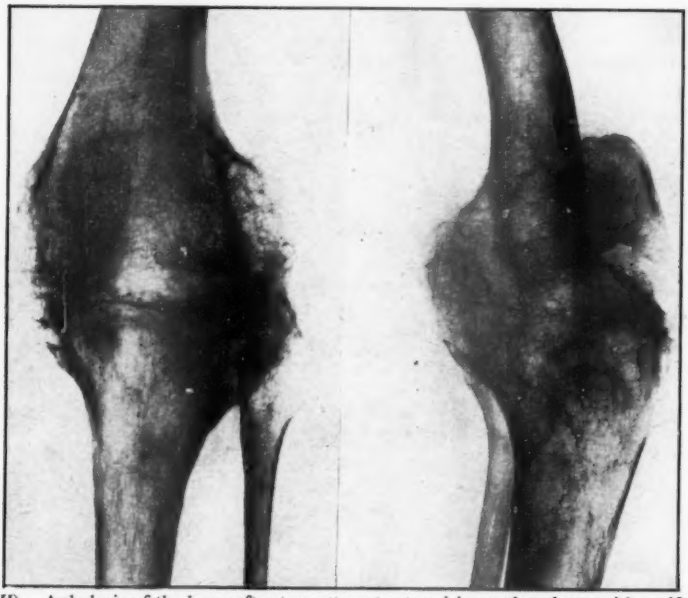


FIG. 4 (*Case III*).—Ankylosis of the knee, after two attempts at excision-arthroplasty, with ossified hæmatoma surrounding the great vessels.

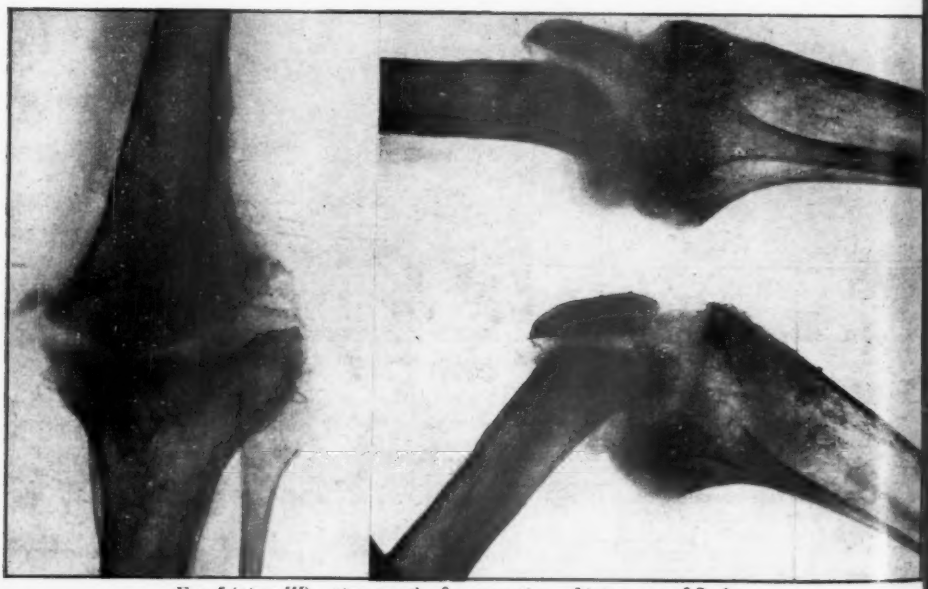


FIG. 5 (*Case III*).—One month after operation. Note range of flexion.

CONCLUSIONS

Ankylosis of the knee in extension in a wheelchair-patient is a handicap severe enough to justify operative mobilization. Subtotal excision of the patella and Hass' arthroplasty of the knee have proved effective. In future such operations should not be needed since ankylosis in paraplegics is always due to serious avoidable faults in their management.

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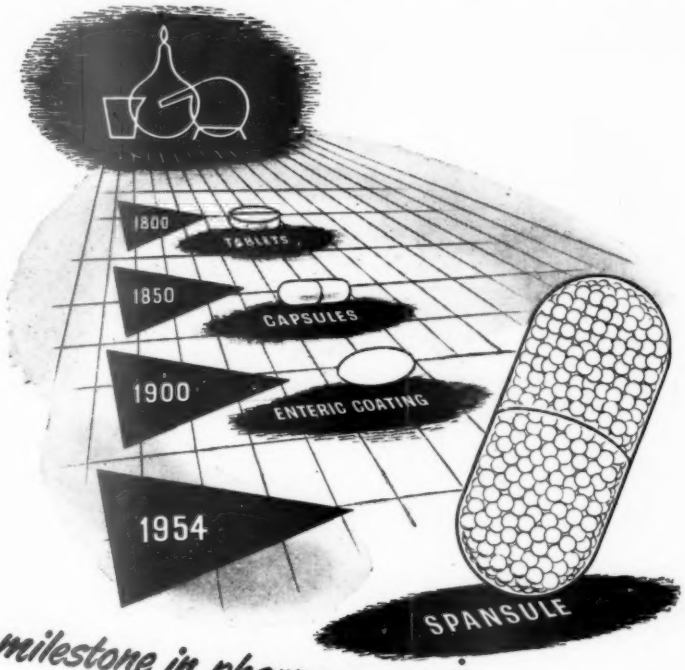

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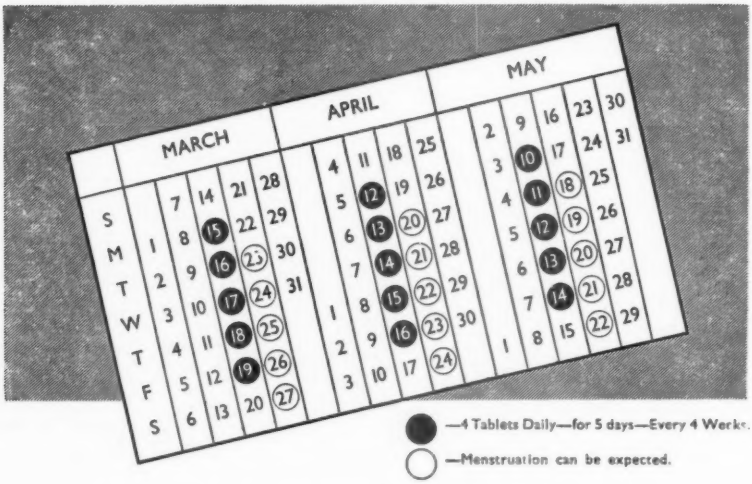

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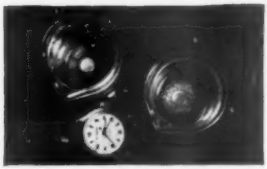
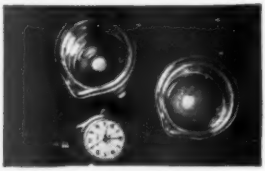


3.20 p.m. Five minutes later, *Filmtab* coating has already started to disintegrate. The tissue-thin film actually begins to dissolve within 30 seconds after the patient swallows tablet.



3.30 p.m. Now coating is now completely dissolved. At this stage, ERYTHROCIN is ready to be absorbed, and ready to destroy sensitive cocci—including those resistant to most other antibiotics.

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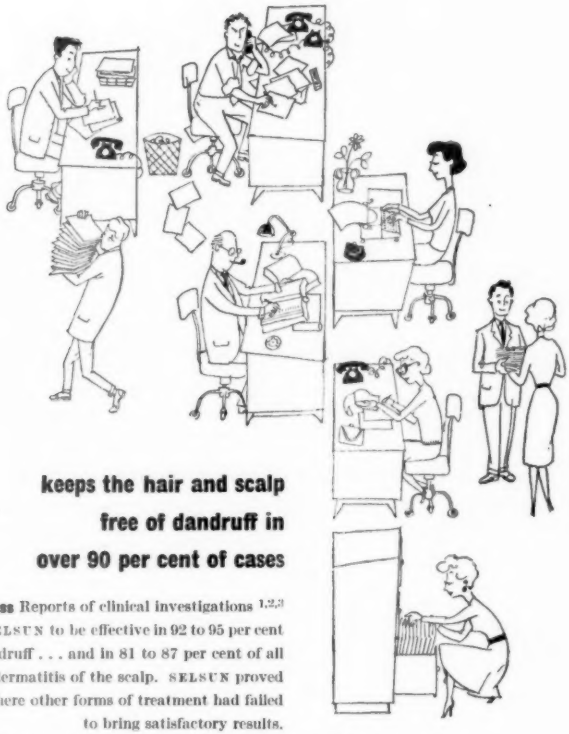

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References:

1 *Slinger, W. N., and Hubbard, D. M.* (1951), *Arch. Dermat. & Syph.*, 64:41, *July.*

2 *Slepyan, A. H.* (1952), *Ibid.*, 65:228, *February.*

3 *Ruch, D. M.* (1951), *Communication to Abbott Laboratories.*

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